February 2021

Binder 033-034, Clinosomidae [Trematoda Taxon Notebooks]

Harold W. Manter Laboratory of Parasitology

Clinostomum intermedialis Lamont, 1920

Type specimen: Cat. No. 196, Mus. Zool., Univ. Mich.; July 20, 1918; Collector A. S. Pearse; taken from the esophagus of Phalacocorax vigua Vieillot (a cormorant).

Description: Some of the largest specimens were at least twice the size of the smaller individuals--an irregularity doubtless due to degree of maturity. The average length was 7 mm. and width 1.5 mm.

Generally, the body takes a regular oblong shape and a distinct neck may be present. The neck may be terete and narrow or flattened ventrally, depending upon the state of contraction in the body. There are no spines present, the body being entirely unarmed.

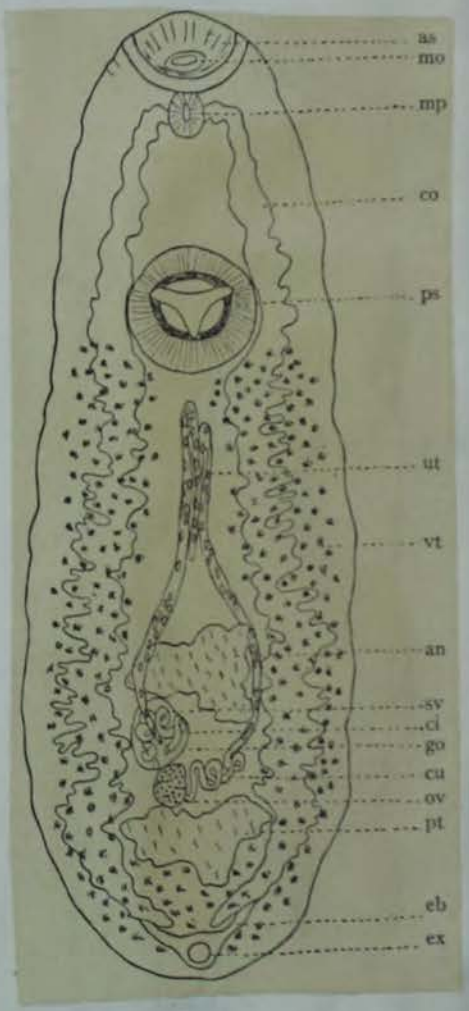
The two suckers are well developed. The anterior one is situated ventrally at the edge of the anterior margin. It is smaller than the posterior sucker, although it often appears larger on account of the protrusion of the surrounding body wall. In some specimens this anterior sucker was in a protruded state, and in others it was drawn down into the body so that it touched the pharynx. The acetabulum is situated ventrally in median line about one-third the length of the body from anterior end. This sucker is deep and has a large triangular opening, around which there is a thick muscular investment.

The digestive system consists of an oral sucker, pharynx, and two simple intestinal branches. The latter extend to the posterior part of the body where they end blindly. Although these coeca remain simple, they become much sacculated by numerous folds; especially in the region from the acetabulum to posterior testes these folds are much more complex.

An excretory pore at the extreme posterior portion of the body is connected with a reservoir-like region from which there are two main lateral branchings. These lateral branches extend forward, taking somewhat the same position as the branches of the intestinal coeca. These excretory branches cannot be traced in toto mounts, but in serial cross-sections the main lateral branches could be followed from caudal reservoir about half the length of the body—almost to the acetabulum. There seem to be many side branches from the main canals but the network is so delicate that it could not be followed.

The two large lobate testes are connected to a coiled cirrus by vasa efferentia. The testes are divided distinctly into three lobes situated in mid-line in the posterior third of the body. The vasa efferentia could be seen only at the point where they entered the cirrus sac. The cirrus sac is about half as large as one testis and has very thin walls. Within the walls of the cirrus sac there is a complicated tubular arrangement by which spermatozoa are

-OVER-



#5 1920

Clinostomum intermedialis Lamont

The adult of this species lives in the esophagus of the cormorant, *Phalacrocorax vigua* Viellot. On July 27, 1918, a bagre (*Rhamdia quelen* Quoy and Gaimard) collected under a rock in the Rio Castaño contained twelve encysted forms distributed as follows: 5 in muscles at base of tail, 1 back of head under skin, 3 under operculum, 3 under membrane covering floor of mouth. Two other bagres collected at the same time were not infected with this parasite. The length of the encysted forms was 6 to 7.5 mm. Similar encysted forms were also found in an eel (*Symbranchus marmoratus* Bloch) caught in the rocks along the shore of Isla del Buro, July 12, and in a sardina, *Astyanax bimaculatus* (L.), collected July 20 at the mouth of the Rio Bue.

conducted from vasa efferentia to the genital pore. Immediately back of the genital opening this convoluted tube becomes narrowed and straightened and finally connects with the penis which leads to the exterior or ventral surface, just below the opening from the uterus. The striking feature about this species is the fact that the cirrus sac lies between testes and not anterior to them.

The female reproductive system consists of an ovary, uterus which fills the region in the body between acetabulum and testes, bounded laterally by intestinal coeca, and vitelline glands with connecting ducts. The ovary is about half the size of the cirrus sac and lies between it and the posterior testis. Observing a specimen from ventral side, the ovary is equidistant between cirrus above, right branch of the intestine, and posterior testis. The ovary takes somewhat of an oval shape and lies a little to one side of the median

In late mounts the uterus was so filled with eggs that the finer connecting ducts were obscure. The uterus and ovary seem to connect directly. After the uterus has made several convolutions in the area between the testes, it runs to the right and forward until it reaches the region between acetabulum and anterior testis where it makes two longitudinal loops, which are bounded laterally by intestinal coeca. In mature specimens the folds of the uterus are crowded with eggs and fill all available space between intestinal coeca, anterior testis, and acetabulum.

Most interesting is the way in which one branch of the uterus extends to the left and downward until it reaches the region of the cirrus sac so that it opens exactly above the opening of the male apparatus. In some mounts the terminal arm of the uterus was small and free from eggs, while in others eggs were present the entire length of the channel, the last egg might be lying at the edge of the genital opening. This shows the close proximity of the two genital openings.

The vitelline glands begin at the level of the acetabulum and extend to posterior part of the body. They are on either side of the coeca with many more on the outer side and only a few scattered on inner margin of intestinal branches. The genital field without vitellaria occupies all the space between acetabulum and excretory pore with coeca laterally—more than one-half the length of the body. The male reproductive system is largely confined to the lower third of the body while the female reproductive system extends nearly to the acetabulum.

Larva: Larval forms of *Clinostomum intermedialis* were found encysted in muscle at base of tail, under skin of operculum, and in the floor of the mouth of a catfish, *Rhamdia quelen* Quoy and Gaimard, collected by Dr. Pearse in the Rio Castano, July 7, 1918. The general appearance and structure are like that of the adult. Length 6 mm.–7.5 mm., width 1 mm.–1.5 mm.

Clinostomum intermedialis Lamont, 1920.

Longueur: 6mm à 7mm,5; largeur maxima: 1mm,5.

Cette espèce est insuffisamment décrite et l'auteur n'a pas jugé nécessaire d'en donner des détails approfondis accompagnés de mesures. Ainsi que nous l'avons dit plus haut, cette espèce est très voisine sinon identique à *C. phalacrocoracis*. *C. intermedialis* a été trouvé une seule fois en grand nombre, chez le Cormoran, *Phalacrocorax vigua* Vieill.

La forme larvaire a été signalée par LAMONT (1920) chez le Silure, *Rhamdia quelen* Quoy et Gaimard. From Bats, 1933

Clinostomatidae

Clinostomum intermedialis Lamont, 1920 - from Price, 1938

A redescription of *Clinostomum intermedialis* Lamont (Trematoda: Clinostomidae), with a key to the species of the genus. EMMETT W. PRICE, U. S. Bureau of Animal Industry.

In 1920, Lamont (Occas. Papers Mus. Zool. Univ. Michigan, No. 83, pp. 1-5) described as *Clinostomum intermedialis* a trematode collected by Dr. A. S. Pearse from a cormorant killed on Lake Valencia, Venezuela, July 29, 1918. Lamont's description of this trematode was very complete except for measurements of certain structures and for an apparently erroneous interpretation of the course of the uterus. Baer (1933, Rev. Suisse Zool., 40(3):317-342) pointed out that should Lamont's interpretation of the course of the uterus be correct, *C. intermedialis* should be placed in a new genus. In order to check this point the writer was able to secure through the courtesy of Dr. George R. LaRue of the University of Michigan the type specimen of Lamont's species and the following description is based upon that specimen.

Clinostomum intermedialis Lamont, 1920

Description.—Body (fig. 5) linguiform, 7.5 mm long by 3.3 mm wide, with slight constriction at level of acetabulum. Oral sucker 390μ in diameter, surrounded by a collar-like structure as in other clinostomes; acetabulum 425μ long by 475μ wide, about 1.7 mm from anterior end of body, acetabular opening circular, cavity triangular. Excretory aperture dorsal, near posterior end of body. Pharynx apparently present; intestinal ceca sinuous, apparently opening into excretory vesicle. Genital aperture at level of posterior margin of anterior testis, slightly to right of median line; cirrus pouch ovoid, 595μ long by 425μ wide. Gonads in distal half of postacetabular portion of body. Anterior testis triangular, 935μ by 935μ in greatest dimensions, with left margin more or less deeply lobed; posterior testis irregularly triangular with apex directed posteriorly, lobed, 595μ long by 1.1 mm wide, situated about 510μ from anterior testis. Ovary globular, 765μ in diameter, immediately posterior to and in contact with uterus pouch; oviduct greatly convoluted; Mehlis' gland conspicuous; Laurer's canal present, opening in middorsal line slightly posterior to level of caudal margin of ovary. Vitellaria extending from level of posterior margin of acetabulum to level of excretory aperture. Ascending limb of uterus (metraduct) long, crossing left lobe of anterior testis and joining stem of uterus 340μ from its anterior end; descending limb passing to right and crossing right lobe of anterior testis. No eggs present.

FIG. 5

Clinostomum intermedialis Lamont. Ventral view

Host.—*Phalacrocorax vigua.*

Location.—Esophagus.

Distribution.—Venezuela.

Type specimen.—Univ. Mich. Mus. Zool. No. 196.

A restudy of the type specimen shows that instead of the uterus making "two longitudinal loops," as stated by Lamont, the nature of this structure is similar to that of other species of the genus. The ascending limb of the uterus, however, is quite long and joins the stem of the uterus far anterad as in *Clinostomum heluans* Dubois (1936, Bull. Soc. Neuchateloise Sci. Nat. (1929), 54:61-72). *C. intermedialis* may be distinguished from the latter species in having the cirrus pouch almost entirely posterior to the anterior testis instead of in the zone of that organ as in *C. heluans*. The only other species with which *C. intermedialis* may be confused is *C. phalacrocoracis* Dubois (1931, Bull. Soc. Neuchateloise Sci. Nat., 55:77-85), but in the latter species the ascending limb of the uterus joins the uterine stem near its base instead of far anterad as in the former.

Up to the present time the following species have been included in the genus *Clinostomum*, s. str.: Adults—*C. attenuatum* Cort, 1913; *C. australiense* Johnston, 1916; *C. complanatum* (Rudolphi, 1814), syn. *C. marginatum* (Rudolphi, 1819); *C. detruncatum* Braun, 1899; *C. folliformе* Braun, 1899; *C. heluans* Braun, 1899; *C. harwoodi* Nicoll, 1914; *C. intermedialis* Lamont, 1920; *C. lambrichti* Braun, 1899; *C. lophopallens* Baer, 1933, syn. *C. lophocirrus* Baer, 1933; *C. phalacrocoracis* Dubois, 1931; *C. pusillum* Lutz, 1928;

From Price, 1938

KEY TO SPECIES OF CLINOSTOMUM

Wash., 2:79-80) is probably that of *C. lambitans*, since it is a very small form and from a locality not far removed from Samaná Bay, Dominican Republic, where *C. lambitans* was originally collected.

The recognizable species of *Clinostomum* may be separated by the following keys:

1. Adult forms 2
   Metacercarial forms 13
2. Gonads in middle of postacetabular portion of body 3
   Gonads caudal to middle of postacetabular portion of body 5
3. Vitelline follicles arranged radially ..... *foliiforme* Braun
   Vitelline follicles not arranged radially 4
4. Vitellaria extending posteriorly as far as tips of intestinal ceca ..... *heroum* Nicoll
   Vitellaria not extending posteriorly as far as tips of intestinal ceca ..... *complanatum* Braun
5. Genital aperture in front of anterior testis 6
   Genital aperture either lateral or posterior to anterior testis 7
6. Genital aperture median ..... *australiense* Johnston
   Genital aperture submedian ..... *attenuatum* Cort
7. Vitelline follicles extending anterior to acetabulum ..... *sorbens* Braun
   Vitelline follicles not extending anterior to acetabulum 8
8. Uterine stem with lateral branches ..... *detruncatum* Braun
   Uterine stem without lateral branches 9
9. Ascending limb of uterus forming a complete loop before entering uterine stem 10
   Ascending limb of uterus not forming loop before entering uterine stem 11
10. Vitellaria extending anteriorly as far as level of equator of acetabulum ..... *lophophallum* Baer
    Vitellaria not extending anteriorly as far as level of posterior margin of acetabulum ..... *vanderhorsti* Ortlepp
11. Ascending limb of uterus very long, joining uterine stem far anteriorly ..... *intermedium* Lamont
    Ascending limb of uterus relatively short, joining uterine stem a short distance in front of anterior testis 12
12. Gonads in extreme posterior portion of body; genital aperture in zone of anterior testis ..... *heluans* Braun
    Gonads somewhat removed from extreme posterior portion of body; genital aperture posterior to anterior testis ..... *phalacrocoracis* Dubois
13. Anterior testis crescent-shaped ..... *pseudoheterostomum* Tubangui
    Anterior testis not crescent-shaped 14
14. Stem of uterus extending posteriorly beyond anterior testis ..... *dietzgomezi* (Monticelli)
    Stem of uterus not extending posteriorly beyond anterior testis 15
15. Genital aperture at level of caudal margin of anterior testis ..... *chrysichthys* Dubois
    Genital aperture near cephalic margin of anterior testis 16
16. Oral sucker about 2/3 as large as acetabulum ..... *dalagi* Tubangui
    Oral sucker about ½ as large as acetabulum ..... *placitusa* Southwell and Prashad

Clinostomum kalappahi Bhalerao, 1947

"Clinostomum kalappahi n. sp. is reported from under the tongue and attached to the buccal wall of cats. It is distinguished from other clinostomes thus: (i) the collar at the anterior end is not continuous, its ends being juxtaposed ventrally; (ii) the anterior testis is U-shaped; (iii) the genital pore lies behind the cirrus, ventrally to the anterior testes; (iv) the centre of the body, anterior to the ventral sucker, is crowded with non-cellular glands."---Helminthol. Abst.

Clinostomum lambitans Braun, 1899.

Longueur: 2mm; largeur maxima: 0mm,6.

Cette espèce est la plus petite du genre. La ventouse orale a 0mm,16 de diamètre et la ventouse ventrale 0mm,36 à 0mm,40. Les organes génitaux se trouvent dans la moitié postérieure du Ver; malheureusement le détail de leur structure n'est pas connu. L'utérus mûr atteint presque le bord postérieur de la ventouse ventrale; il en est de même des glandes vitellogènes. Les œufs ont 72 μ à 91 μ de long et 52 μ de diamètre. Adulte chez *Ardea sp.* (Baie de Semana.) Développement inconnu. From Baer, 1933

from Braun, 1900 (Host Ardea sp.)

from Braun, 1900

Clinostomum lophophallum sp. nov. Bals, 1933

Longueur: 8mm,5 à 10mm. Largeur maxima: 2mm,5.

La ventouse orale mesure 0mm,61 sur 0mm,48. Il y a un petit pharynx rudimentaire. La ventouse ventrale a 1mm,2 à 1mm,5 de diamètre. La cuticule est armée, surtout à la face ventrale du Ver. Les organes génitaux se trouvent dans la moitié postérieure du Ver. Le pore génital est situé à droite de la ligne médiane au niveau du testicule antérieur. L'utérus mûr s'étend presque jusqu'à la ventouse ventrale. Les glandes vitellogènes forment deux bandes latérales se réunissant en avant et en arrière des organes génitaux. Les œufs ont 110 μ à 118 μ de long et 68 μ à 76 μ de diamètre. Adulte chez *Phoyx purpurea manillensis* (Meyer). Développement inconnu.

From Bals, 1933

Clinostomum macrosomum n. sp. Jaiswal, 1957

In March, 1951, a solitary metacercarial form of the above species w[illegible] recovered from the intestine of the fish "Kali Marrel", *Channa (Ophicephalu[illegible]atus*.

This immature distome has a large body measuring 22.43 mm. in length[illegible].0 mm. in maximum width, which is attained at about the middle of the body. In size th[illegible]ture stage, parasitic in a medium sized fish, forms the largest metacercarial form o[illegible]*um* so far described. The body is elongate and elliptical in shape with rounded extremit[illegible]tegument is thin and studded with backwardly directed minute spines. The subter[illegible] sucker is somewhat oval and cup-shaped, measuring 1.06 by 0.66 mm. The acetabul[illegible]developed and nearly rounded in shape, measuring 1.86 mm. in diameter. It is placed[illegible]terior one fifth of the body, not far from the oral sucker. The distance between the tw[illegible] 1.66 mm. and their size ratio is 1 : 1.75.

Prepharynx and Pharynx being absent, the mouth leads directly into [illegible]sophagus measuring 0.33 mm. in length. The oesophagus bifurcates into two long int[illegible]ra, which run through the entire length of the body to the caudal end. They are thin[illegible]sacculate in the pre-acetabular region, whilst posteriorly they gradually increase in thi[illegible]nd become corrugated. In the post-testicular region the caeca taper gradually to termin[illegible]inted tips near the caudal end. The excretory pore is situated at the extreme posterio[illegible]The gonads lie immediately behind the equatorial level of post-acetabular portion of the[illegible] The testes are in tandem and more or less median in position. They are irregular in sh[illegible]h indented margins, the anterior testis measuring 1.53 by 2.0 mm. and hind testis 1.[illegible] mm. The cirrus sac is thin and elongate, lying lateral to the ovary between it and the [illegible]aecum. It encloses the vesicula seminalis and feebly developed cirrus. The genital pore[illegible]ated distinctly posterior to the caudal margin of the anterior testis.

The ovary is centrally located between the two testes. It measures [illegible].6 mm. and has a slightly indented posterior margin. The oviduct arises from the anterior [illegible]ter of the ovary and is continued into the utero-duct, the latter curves round the anterior testis [illegible]ming anteriorly into the uterine sac which is tubular and median in position. The sac occupie[illegible]th of the length between the anterior testis and the acetabulum, and by means of a short convoluted metraterm, communicates with the exterior. The genital opening is found on the right side of the median line immediately anterior to the level of the ovary as shown in fig. 5. The vitellaria consist of small rounded follicles which extend from the level of hind border of acetabulum to the caudal end, terminating slightly anterior to the ends of the caeca. The vitelline follicles are mostly distributed in the lateral zones of the body whilst posterior to hind testis they merge together in the middle.

Discussion: Tubangui (1954) described *C. ophicephali* from the fish, *Opicephalus striatus* in Japan which differs from the form under discussion also found in the same host in Hyderabad, in the extreme caudal position of the gonads and the uterine sac, which do not extend forwards beyond the equatorial level of the post-acetabular portion of the body. The species under study resembles *C. indicum* Bhalerao 1953, in having the genital pore far posterior to the hind border of front testis. It can, however, be differentiated from this species by the possession of distinctly larger suckers and by marked differences in shape and in principal body measurements. It is, therefore, concluded that the form described above is new to science.

It is proposed to name it *Clinostomum macrosomum* n. sp.

Specific diagnosis: Body 22.43 mm. by 6.0 mm.; suckers unequal, oral sucker 1.06 by 0.66 mm.; acetabulum 1.86 mm. in diameter; intestinal caeca non-sacculate in pre-acetabular region but much distended and corrugated behind; testes irregular, digitate placed behind the equatorial level of post-acetabular portion of the body, anterior testis 1.53 by 2.0 mm., posterior one 1.7 by 1.7 mm.; ovary 0.7 by 0.6 mm., somewhat rounded with indented posterior margin, placed between testes; uterine sac elongate and tubular.

Host: *Channa (Ophicephalus) striatus.*

Habitat: Intestine.

Locality: Hyderabad Deccan (India).

The type specimen has been deposited in the Museum of Zoology Department, College of Science, Osmania University.

Fig. 5. *Clinostomum macrosomum* n. sp. Dorsal View.

2. - **Clinostomum macrosomum** Jaiswal, 1957. Nrs. 32-674; 32-675; 32-676; 32-677. Metacercariae.

Host: *Tilapia nilotica* (Linn.); (Cichlidae). - Location: On host, probably in nodules under the skin; apparently unencysted. - Locality: Lac Mugesera, Ruanda. - Collector: G. Marlier. - Dates: 23, 26, and 30 March, 1960.

This species is identified chiefly on the basis of its very large size (18 to 27 by 4 to 7 mm). It is known hitherto from a fish, « *Channa (Ophiocephalus) striatus* Bloch » in India (Jaiswal, 1957).

From Manter & Pritchard, 1969

Clinostomum marginatum (Rud.,1819) Braun, 1899

Syn. of Clinostomum complanatum (Rud., 1809) — See Dowsett and Lubinsky (1980) for discussion of synonymy

type from Braun 1900
(last Rudolphi case)

Clinostomum marginatum (Rudolphi, 1819)

Matériel étudié :

24 Trématodes identiques récoltés chez un Ardéiforme, *Bubulcus ibis* (L.) provenant de Tananarive, et répartis comme suit : 11 dans le gésier, 10 dans la cavité générale et 3 dans les sinus nasaux.

Description (voir fig. 3).

Corps allongé, ovale dont la longueur est comprise entre 2.500 et 4.925 μ, et la largeur entre 700 et 1.325 μ.

Corps couvert de petites épines.

Ventouse orale, terminale, de petite taille (210 à 240 μ de diamètre). Acétabulum plus grand (470 à 575 μ de diamètre), dont le bord postérieur marque la limite du premier tiers du corps.

Appareil digestif : pas de pharynx musculaire bien marqué. Les coeca intestinaux atteignent l'extrémité postérieure. Leur paroi est fortement plissée.

Appareil génital mâle : les deux testicules, de forme triangulaire, à contours lobés, sont disposés l'un au dessous de l'autre dans la moitié postérieure de la longueur du corps. A peu près de même taille, ils mesurent 400 μ transversalement et de 250 à 450 μ longitudinalement.

A droite de chaque testicule, part un canal déférent qui se dirige vers l'arrière pour le testicule antérieur, et vers l'avant pour le testicule postérieur. Ces deux canaux arrivent dorsalement à l'extrémité postérieure de la poche du cirre qui est située à droite et s'ouvre en arrière du testicule antérieur. La poche du cirre est ovale, petite (120 × 250 μ). La vésicule séminale, interne, occupe la base de cette poche.

Appareil génital femelle : l'ovaire petit (de 120 à 150 μ de largeur, 180 à 230 μ de longueur) à bord non lobé, est situé dorsalement, en arrière de la poche du cirre, dans l'espace intertesticulaire.

L'oviducte, le réceptacle séminal, la glande de Mehlis n'étaient pas visibles sur les préparations.

Les vitellogènes s'étendent de la limite inférieure de l'acetabulum à la région postérieure intercoecale, très largement, de part et d'autre de l'appareil génital. Ils sont formés de nombreux petits follicules qui, chez certains spécimens, sont disposés en bandes transversales. Vitelloductes horizontaux passant en avant du testicule postérieur, entre lui et l'ensemble ovaire-utérus.

L'utérus débute dans l'espace intertesticulaire par de nombreux replis et remonte le long du bord gauche du testicule antérieur.

Au sommet de celui-ci, l'utérus émet en avant un sac utérin, longitudinal qui se termine juste en arrière de l'acetabulum ; la partie descendante de l'utérus longe le bord droit du testicule antérieur, en avant de l'orifice génital mâle.

Une seule préparation nous a permis d'observer les œufs qui sont ovales et de grande taille (60 à 70 μ sur 100 à 120 μ).

Appareil excréteur : il se compose de deux canaux longitudinaux de faible section, visibles dans l'espace compris entre les coeca et les parois latérales du corps, depuis l'acetabulum jusqu'à l'extrémité postérieure du corps. Dans la région postérieure, ces canaux sont dilatés et fusionnent pour former un canal excréteur impair, très court, qui débouche à l'extérieur au niveau d'un pore terminal. A leur extrémité postérieure, les coeca, chez certains de nos échantillons, communiquent avec la portion dilatée des canaux excréteurs.

Fig. 3. — *Clinostomum marginatum* (Rud. 1819) chez *Bubulcus ibis* (L., 1758). Tananarive. Ex. entier, vue ventrale.

Discussion :

Les caractères qui précèdent (ovaire situé entre les testicules, utérus formé d'une branche ascendante et d'une branche descendante) indiquent une espèce du genre *Clinostomum* ; pour sa détermination, il est nécessaire de procéder par élimination successive des espèces connues dans ce genre (cf. Yamaguti, 1958, pp. 687 à 689).

1° Nous écarterons tout d'abord quatre espèces dont les caractères sont de toute évidence bien différents de ceux de nos échantillons :

Cl. heluans Braun, 1899, parasite d'*Ardea coerulea* L. et *Nycticorax gardeni* Gm. *Ardeidae*), et chez laquelle le complexe ovaire + testicules est situé dans le quart postérieur de la longueur du corps ; *Cl. sorbens* Braun,

-over-

1899, décrite chez *Tantalus loculator* L., 1758 (*Ciconiidae*), et qui présente des vitellogènes s'étendant en avant de l'acetabulum et des testicules, de très grande taille, occupant presque toute la largeur du corps ; *Cl. attenuatum* Cort, 1913, décrite chez *Botaurus lentiginosus* (Mont.) (*Ardeidae*), et dont la cuticule porte de grosses epines ; *Cl. detruncatum* Braun, 1899, parasite de *Nycteria americana* L., 1758 (*Ciconiidae*), et dont le pore génital est situé sagittalement en arrière du testicule antérieur.

2° Nous écarterons en second lieu, 3 espèces de grande taille (6 à 15 mm), *Cl. phalacrocoracis* Dubois, 1930, *Cl. intermedialis* Lamont, 1920, et *Cl. australiense* Johnston, 1916, qui diffèrent nettement de nos échantillons par ce caractère et la position de l'orifice génital.

Cl. phalacrocoracis Dubois, 1930, et *Cl. intermedialis* Lamont, 1920, décrites respectivement chez *Phalacrocorax levaillanti* (Licht.) et *Ph. viqua* Vieill. (*Phalacrocoracidae*), diffèrent en outre de nos spécimens par la position de l'orifice génital situé entre les testicules. Une telle disposition ayant été observée par trois auteurs, Dubois (1930), Lamont (1920) et Stunkard (1938), il semble qu'il s'agisse là d'un bon caractère diagnostique, bien que J. G. Baer (1933) pense que la position de l'orifice génital varie d'un individu à l'autre.

Cl. australiense décrit par Johnston (1916) chez *Plotus novaehollandiae* Gorla (*Phalacrocoracidae*), possède de très grandes affinités avec *Cl. phalacrocoracis*, sans présenter toutefois la même disposition de l'orifice génital qui est situé en avant et à droite du testicule antérieur ; ceci le distingue en outre de nos échantillons.

3° En faisant abstraction de *Cl. complanatum* (Rudolphi, 1819) et de son synonyme *Cl. hornum* Nicoll, 1914 (voir T. Maccagno, 1934, pp. 7-11 ; S. Yamaguti, 1933, p. 71 ; R. Ph. Dollfus, 1950, p. 82, note 4), il reste une série d'espèces décrites chez des Ardéiformes : *Cl. marginatum* (Rud., 1819), *Cl. foliiforme* Braun, 1899, *Cl. lophophallum* Baer, 1933, *Cl. vanderhorsti* Ortlepp, 1935 et *Cl. sp.* Dollfus, 1950.

Entre *Cl. foliiforme* décrit chez *Ardea purpurea* L., par Braun, et *Cl. marginatum*, décrit lui aussi par Braun chez *Ardea sp.*, la seule différence constatée est la disposition en bandes transversales des vitellogènes ; nous avons observé une telle disposition chez certains de nos spécimens et R. Ph. Dollfus (1950, p. 82), a montré qu'il s'agissait d'un caractère individuel, par conséquent inutilisable pour une discrimination spécifique.

Cl. lophophallum décrit par J. G. Baer chez *Phoyx purpurea manillensis* Meyer), se rapproche beaucoup de nos spécimens dont nous ne pouvons le différencier qu'au moyen de mensurations (corps, testicules, ovaires). Il posséderait, selon Baer (1933, p. 321), un réservoir vitellin que nous n'avons pu observer sur nos échantillons ; on remarquera toutefois qu'au niveau où confluent les deux vitelloductes, le canal est toujours dilaté et forme une poche d'importance variable selon le volume de vitellus qu'elle contient.

Cl. vanderhorsti Ortlepp, 1935 décrit chez une *Ardea melanocephala* V. et Ch., d'Afrique, différerait de *Cl. lophophallum* par deux caractères : l'absence de pharynx, et la communication entre coeca et canaux excréteurs. Nous pensons, d'après les diverses figures de *Clinostomum* données par les auteurs, que le pharynx représente, dans ce genre, un organe plus ou moins rudimentaire de faible valeur diagnostique. Par ailleurs, nous ne sommes pas sûrs que la communication entre coeca et tubes urinaires, souvent difficile à observer, représente un caractère suffisant pour différencier les espèces de *Clinostomum* ; R. Ph. Dollfus (1950) ne l'a noté (p. 80) qu'avec réserve chez ses spécimens de *Cl. sp.*, et il n'a pu être observé que chez quelques uns des échantillons ci-dessus décrits.

Cl. sp. décrit par R. Ph. Dollfus (1950) chez *Ardea goliath* Cretzsch, du Congo, est lui aussi, aux dimensions près, morphologiquement identique à *Cl. marginatum*.

Compte tenu de cette synonymie probable, et du fait que nos échantillons correspondent de manière satisfaisante à la redescription du type de *Cl. marginatum* par Braun (1900, p. 28), nous proposons de rapporter nos spécimens à *Cl. marginatum* (Rudolphi, 1819).

Nous remarquerons que nos spécimens sont également très proches de *Cl. complanatum* d'*Ardea purpurea* L. de Camargue, dont la figure est donnée par Dollfus (1950, fig. 58) et qu'en ces conditions la synonymie *marginatum* = *complanatum* envisagée par cet auteur (p. 82, note 4), semble fort probable.

FROM RICHARD (1962)

Clinostomatidae

NOTE ON THE LIFE HISTORY OF *CLINOSTOMUM MARGINATUM* (TREMATODA)*

SEWELL H. HOPKINS

Unsuccessful attempts to work out the life cycle of *Clinostomum marginatum* (Rudolphi 1819) have been made by several investigators, notably Osborn (1911), Linton (1912), and Smallwood (1914). I worked on this problem during the year 1928–1929, and though unsuccessful in the attempt to find the cercaria and precercarial stages I discovered some facts concerning the structure and development of the metacercaria which may aid others in finding the cercaria of this common parasite.

The metacercaria of *Clinostomum marginatum* has been reported from 30 or more species of fish and from frogs (*Rana* spp.); H. J. Van Cleave has found it in a snake, *Thamnophis radix*. The parasites lie in cysts, usually in the body wall of the host; frequently some of the cysts lie just below the skin, causing nodular swellings about the size of a pin head which are quite conspicuous on external examination. The adults occur in the oral cavity and esophagus of herons, bitterns, and gulls. The geographical range apparently includes Brazil and most of eastern North America.

I have obtained a complete series of growth stages of the metacercaria from pirate perch, *Aphredoderus sayanus*, caught in drainage ditches of Champaign County, Illinois. The smallest metacercariae are only about 0.2 mm long; they are of ovoidal form, with a terminal or subterminal oral sucker and a relatively enormous ventral sucker forming nearly one-third the volume of the body (Fig. 1). The oral sucker is 40 to 60μ and the ventral sucker 80 to 130μ in diameter. The posterior tip of the body projects little if any beyond the ventral sucker. The broad intestinal crura end at the level of the ventral sucker. In older worms, between 0.2 and 0.5 mm long, the posterior tip of the body extends dorsad from the acetabular region as a small sharply tapered projection; in 0.9 mm specimens the post-acetabular region is about as long as the pre-acetabular region, but more slender (Fig. 2, 3). A graph in which the length of the pre-acetabular region and the length of the post-acetabular region are plotted against the total body length shows that the length of the post-acetabular region increases at a constant rate, while that of the pre-acetabular region increases at a constantly decreasing rate; this process apparently continues throughout the life of the metacercaria, so that the post-acetabular region forms by far the greater part of the body in the largest individuals. The invaginated anterior region known as the oral field makes its first appearance in metacercariae about 1.2 mm long. Individuals 2.0 mm long are typical Clinostomum metacercariae in every respect, further development affecting only proportions (Fig. 4).

Eyespots were found in the metacercaria for the first time. The two black eyespots are very conspicuous in the 0.2 mm larvae; they become less conspicuous as the size of the body increases, but by careful focusing can still be seen in 2.0 mm specimens. They are located one on each side of the pharyngeal chamber (there is no true muscular pharynx in this species), near the dorsal surface of the body; each pigment cup is about 5μ in diameter.

One may therefore expect the cercaria of *Clinostomum marginatum* to conform to the following description: A distome cercaria approximately 0.2 mm long, with a subterminal ventral sucker nearly one-third as large as the entire body and about twice as large as the oral sucker, a pair of pigmented eyespots 5μ in diameter, and no true muscular pharynx. Nothing can be said about the type of tail to be expected. The youngest metacercariae were found in July and August, so the cercariae are probably most abundant in the summer. The metacercariae collected in spring, autumn and winter range from 2.5 to 5.5 mm long; I found from 1 to 125 of these large metacercariae in each infested pirate perch. Of 50 pirate perch caught in one ditch, 33 were infested. About 85 per cent of the cysts were in the body wall, indicating infestation by penetration from the outside.

From Hopkins, 1933

Clinostomum marginatum Rudolphi, 1819

C. marginatum was originally found in Brazil (Cort, 1913) but was first reported in North America by Leidy (1856) and is known now to be widely distributed. *C. marginatum* metacercariae are herein reported from *Catostomus insignis* and *C. clarki* from the Upper Salt River at the Salt River Canyon, Arizona, during July 1966—new host and locality records. For a complete account of intermediate and final hosts see Amin (1968: 121-138). Of 24 known definitive bird hosts, eight were reported from Arizona by Lowe (1964) — *Ardea herodias, Botaurus lentiginosus, Chlidonias nigra surinamensis, Larus argentatus, Nyctanassa violacea, Nycticorax nycticorax, Phalacrocorax a. auritus,* and *Sterna hirundo.*

The metacercarial cysts of *C. marginatum* are creamy white spherical balls from 1.5 to 3.0 mm in diameter. See Osborn (1911) and Hunter and Dalton (1939) for cyst wall origin and anatomy. Unprocessed excysted worms kept in saline solution at 5 C remained alive for a week. During this period, the worms were observed to exhibit active movements of expansion and contraction.

The anatomy of the worm was described in considerable detail by MacCallum (1899) and Osborn (1912). Of 165 larvae recovered, 136 were whole mounted. The body length was 2.49 to 6.04 mm, mean = 3.727 (N = 136). The forebody length was 0.65 to 1.43 mm, mean = 0.937 (N = 136). The hindbody length was 1.80 to 4.61 mm, mean = 2.787 (N = 136). The maximum body width (invariably between the two testes) was 0.86 to 1.67 mm, mean = 1.234 (N = 133). The width at the acetabular constriction was 0.45 to 1.14 mm, mean = 0.801 (N = 133). The width of the oral sucker was 0.16 to 0.29 mm, mean = 0.230 (N = 123). The width of the ventral sucker (acetabulum) was 0.37 to 0.65 mm, mean = 0.493 (N = 135).

Most of the earlier records of metacercariae of this species were from the body musculature and under the body wall. However, of the 165 worms recovered, 122 (73.94%) were recovered from the gill filaments, rakers and branchial chamber, 18 (10.91%) from the body musculature at various depths, 15 (9.09%) from under the skin, 7 (4.24%) from the fin rays, 2 (1.21%) from the eye socket, and 1 (0.61%) from the heart.

Of 17 *C. insignis* and four *C. clarki* examined from the Upper Salt River, 16 (94.12%) of the first and three (75.00%) of the second species were found infected. This relatively similar frequency of infection is partially because penetration of the cercariae into the host body wall is a function of exposure and is independent of the fish feeding behavior. However, the higher infection rate in *C. insignis* (0-40 worms per host, mean = 8.71) than in *C. clarki* (0-13 worms per host, mean = 4.25) may be due to the speed of current. In the swifter waters(inhabited by *C. clarki*) the cercariae may have fewer chances of successfully finding and penetrating the fish-host, as has been previously suggested by Nigrelli (1936).

No ill effects were apparent and hosts with the heaviest infection (40 cysts) appeared as healthy as the uninfected ones.

Morphological growth study. — The 136 whole-mounted metacercariae were divided into six size classes according to their total length. The specimens of the first class measured between 2.49 and 3.00 mm. Each of the subsequent classes from the second through the fifth covered 0.50 mm. Specimens of the sixth class measured between 5.00 and 6.04 mm. Sample size was 10, 44, 45, 19, 11, and 5 in the classes 1 to 6, respectively.

These specimens assumed a variety of shapes which could be assigned to two major body forms characterized by the medium and the large sizes (Figs. 3C and D, respectively). The 0.15 mm long metacercaria in Fig. 3B is after Hopkins (1933). The smallest specimens are almost oval in shape with a terminal oral sucker, a large posterior ventral sucker, and posteriorly extending intestinal caeca. The next stages indicate a rapid increase in length of the hindbody coupled with a slower increase in length of forebody. The increase in the tissue volume of the hindbody contains developing reproductive system and intestinal caeca. The acetabular constriction becomes more pronounced in older worms.

While the forebody length increases slowly from a mean of 0.776 mm in the first class to a maximum of 1.290 mm in the last (a net increase of 65.38%), the hindbody length increases at a faster rate from a mean of 2.034 mm in the first class to a peak of 4.056 mm in the last (a net increase of 97.54%) (Fig. 4A). Figure 4B shows an increase in ratio of the hindbody to forebody from a mean of 2.636 in the first class to a maximum of 3.260 in the fifth. The mean of 3.149 in the sixth class might be due to a small sample size (N = 5). These results clearly demonstrate that the maximum growth in length of *Clinostomum marginatum* metacercariae is localized in the postacetabular region where the reproductive activity occurs (see *I. hexacotyle* above).

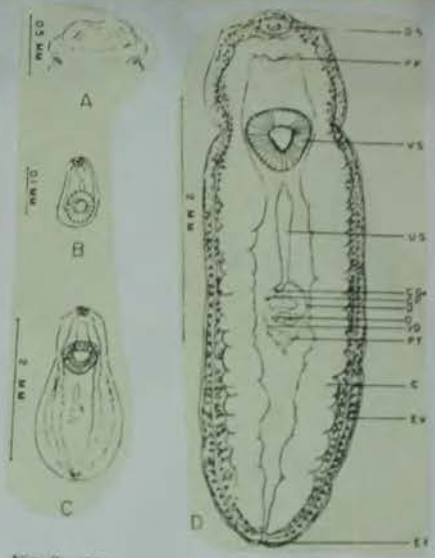


Fig. 3.—Metacercariae of *Clinostomum marginatum*

Growth of the other characters has been discussed (see Amin, 1968, for more details and illustrations), a brief summary of which follows. The oral sucker appears to continue growing in width between the middle-sized and large-sized specimens. It increases from a mean of 0.213 mm in the first class to a maximum of 0.249 mm in the fifth (a net increase of 19.05%). A mean of 0.234 mm in the sixth class is probably due to small sample size of five. The ventral sucker appears to have attained its maximum width in the medium-sized specimens.

The ratio of acetabular width to body length decreases at a slightly lower rate than does that of maximum width/body length.

From Amin 1969

See reprint for Figs. 4A and 4B

Clinostomum mastacembeli n. sp. Jaiswal, 1957

In December, 1953, two specimens of this new metacercarial stage were recovered by the writer from the small intestine of a Bam, *Mastacembelus armatus*.

The flukes have an elongate and elliptical body with rounded anterior and posterior ends, measuring 17.17—17.56 mm. in length and 4.4—4.51 mm. in maximum width which is attained at about the middle of the body. The cuticle covering the body surface is thin and armed with spines, which are more numerous posteriorly than anteriorly. The oral sucker is subterminal, measuring 0.84—0.9 by 0.66—0.7 mm. The acetabulum is well developed and is oval in shape measuring 1.7—1.93 by 1.4—1.56 mm. It is situated at about $^3/_8$th of the body length from the anterior end and is separated from the oral sucker by a distance of 1.86 mm. It is more than double the size of the oral sucker and the ratio between the two is 1 : 2.14.

The mouth surrounded by the oral sucker leads directly into a small oesophagus, 0.13 mm. long, which immediately divides into two caeca. The latter run through the entire length of the body terminating blindly at the caudal end. The walls of the caeca are sacculated more so posteriorly than towards the acetabulum.

The gonads lie distinctly posterior to the middle of the post-acetabular region. The testes are in tandem and deeply lobed, front testis measuring 1.36—1.76 by 1.4—1.8 mm. and hind testis 0.84—1.7 by 1.4—1.47 mm. The two testes are situated in the 3rd and 4th quarters of the post-acetabular portion with their lateral borders almost reaching the caeca. The cirrus sac is pear-shaped and is situated lateral to the ovary. It encloses a convoluted vesicula seminalis, ductus ejaculatorius and the cirrus.

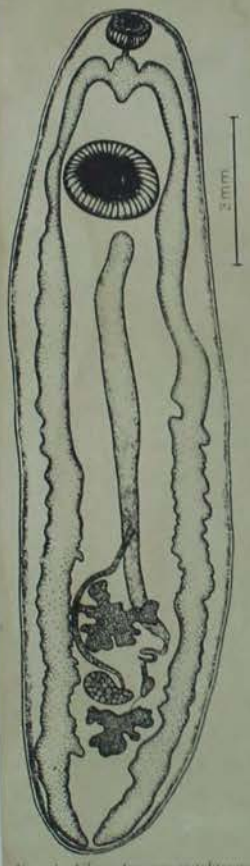


Fig. 6. *Clinostomum mastacembeli* n. sp. Ventral View.

The ovary is entire and bean-shaped, situated somewhat closer to the posterior testis. It measures 1.05—1.15 by 0.57—0.76 mm. The oviduct arises from the anterior margin of the ovary and then proceeds as uterio-duct round the external margin of the anterior testis to open into a wide uterine sac. The latter extends anteriorly almost to the hind border of the acetabulum. It appears in the form of an elongated and somewhat swollen median tube, measuring 7.5—8.3 mm. in length. It extends posteriorly to the level of the hind border of the anterior testis, where by means of a S-shaped narrow metraterm it opens into the genital atrium. The gonopore is placed somewhat laterally at about the level of the hind border of the anterior testis. The vitellaria in the specimen under observation were not developed.

Discussion: The metacercarial form described above is allied to the preceding form *C. macrosomum* n. sp. from *Channa striatus* described in this paper. It, however, differs from it in the following respects: (1) In the smaller size and shape of the body. (2) In the size and disposition of the suckers—the acetabulum being slightly more than double the size of the oral sucker, the ratio between the two suckers being 1 : 2.14 in the species under discussion and 1 : 1.7 in *C. macrosomum*. (3) Sacculations in the walls of the caeca are more prominent in *C. macrosomum* than in *C. mastacembeli*. (4) The gonads in *C. macrosomum* are immediately posterior to the middle of the post acetabular portion whilst they are distinctly posterior to this level in *C. mastacembeli*. (5) The uterine sac is comparatively longer in *C. mastacembeli*.

In view of the differences exhibited the form described above constitutes a new species. It is proposed to designate it *Clinostomum mastacembeli*.

Specific diagnosis: Body 17.17—17.56 by 4.4—4.51 mm.; suckers unequal, oral sucker 0.84—0.9 by 0.66—0.7 mm.; acetabulum 1.7—1.93 by 1.4—1.56 mm., intestinal caeca sacculated posteriorly with blind swollen tips; testes deeply lobed placed in caudal region of body, anterior testis 1.36—1.76 by 1.4—1.8 mm., posterior 0.84—1.7 by 1.4—1.47 mm.; ovary 1.04—1.15 by 0.57—0.76 mm., bean-shaped, closer

to posterior testis; uterine sac much elongate and tubular approaching almost acetabulum.

Host: *Mastacembelus armatus.*

Habitat: Small intestine.

Locality: Hyderabad State.

The type specimens are deposited in the Zoological Museum of the Osmania University.

CLINOSTOMUM MASTACEMBELI, JAISWAL 1957

(Fig. 1.)

HOST : *Notopterus notopterus* (Pallas).

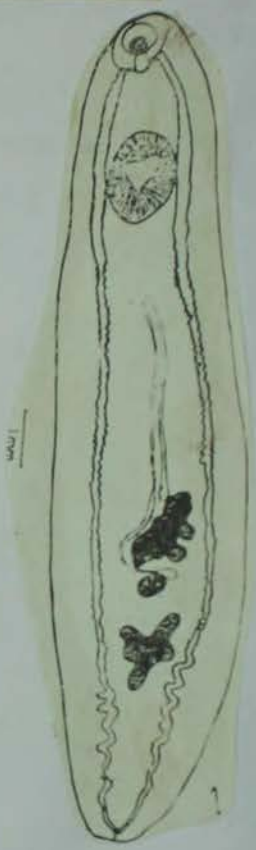
LOCATION : Intestine.

LOCALITY : Kalri lake (Sind) Area (West Pakistan).

NUMBER OF SPECIMEN EXAMINED : 5.

NUMBER OF HOST EXAMINED : 4.

Metacercariae were creamy white in colour when alive. Body aspinous, stout, lenguiform convex dorsally and concave ventrally measuring 14.37—15.00 mm long maximum. Breadth at testicular region 4.37—4.62 mm. Fore-body measures 1.56—1.68 mm in length. Oral sucker subterminal, poorly developed, measuring 0.31—0.32 mm in diameter. Pharynx small, Esophagus not distinct, Ceca with sinous wall ; opening into excretory vesicle by a narrow passage posteriorly. Acetabulum in anterior third of the body measuring 1.43—1.56 mm in length, 1.56—1.62 mm in width. Suckers ratio 1 : 3.1—1 : 4.1. Testes in posterior half of the body 3—5, lobed, measuring 0.93—1.00 mm long, 1.25—1.56 mm wide. Cirrus pouch small anterior to anterior testes. Genital atrium in front of anterior testes. Ovary on right of medium line between two testes 0.31—0.32 mm in length, 0.62—0.63 mm in width. Uterus long terminating at a distance of 1.25—1.31 mm from the acetabulum. Vitellaria confined to hind body. Excretory plexus extending in peripheral parenchyma. Excretory vesicle small and V shaped, in between the ceca. There are nodes and lesion are present in site of infection in intestine.



REMARKS.

The present specimens resemble to *Clinostmum mastacembeli* Jaiswal, 1957. In the body size, in testes size and position of the ovary the present specimen is similar to *C. mastacembeli*. Due to closer resemblance to *C. mastacembeli*, the specimens are regarded as same species.

From Saeed and Bilqees, 1972

Clinostomatidae

CLINOSTOMUM ORIENTALE. ~~n. sp.~~ R. P. MUKHERJEE, 1967

(Fig. 1)

A large number of non-encysted specimens of this parasite were collected from the intestine of a fish, *Gadusia chapra* (Ham) at Calcutta.

They are long, slender with both extremities bluntly rounded. The anterior end and the sides are slightly bent ventrally. The cuticular spines are absent. Anteriorly the body is slightly constricted at the middle level of the ventral sucker. They are 4.64* (4.47-4.78) long and 1.56 (1.48-1.73) broad. The maximum breadth is noticed in the region of the gonads. The subterminal oral sucker measures 0.12 (0.08-0.14) in length and 0.27 (0.23-0.31) in breadth. The muscular ventral sucker measures 0.74 (0.73-0.77) in length and 0.70 (0.67-0.74) in breadth.

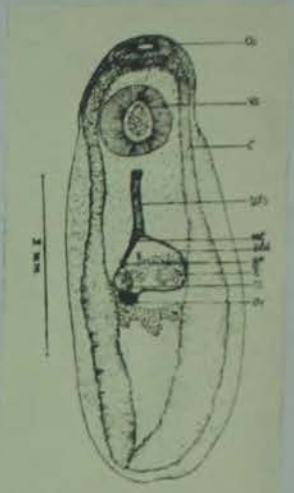
The mouth is surrounded by the oral sucker and the prepharynx and pharynx are absent. The long intestinal caeca not deeply diverticulated and have terminated near the posterior end of the body. They neither open to the outside nor they open to the excretory bladder.

The gonads are situated slightly posterior to middle region of the body. The tandem testes are strongly and irregularly lobed. The anterior testis measures 0.37(0.35-0.42) in length and 0.43(0.31-0.50) in breadth. The posterior testis measures 0.29(0.23-0.33) in length and 0.52(0.31-0.64) in breadth. The cirrus sac is located just above the ovary in the space between the anterior testis and intestinal caeca. It measures 0.19(0.16-0.23) in length and 0.37(0.29-0.46) in breadth. It contains the vesicula seminalis, the pars prostatica and the ductus ejaculatorius. Genital pore is situated at about the level of the equator of the anterior testis.

The unlobed ovary is situated just below the cirrus sac and measures 0.19(0.17-0.20) in length and 0.08(0.06-0.09) in breadth. The oviduct which starts from the inner side of it runs transversely in the intertesticular space and finally forms the uteroduct which runs along the margin of the anterior testis and opens into the uterine sac, immediately in front of the anterior testis. The uterine sac is long, tubular structure and measures 0.72(0.67-0.81) in length and 0.14(0.12-0.19) in breadth. It terminates 0.17(0.12-0.23) from the posterior end of the ventral sucker. The metraterm is 0.32(0.27-0.302) long and 0.07 (0.04-0.09) broad. The vitelline follicles are not visible.

The present species comes close to *Clinostomum dalagi* Tubangui (1933) but differs from it in the absence of cuticular spines, structure of the testes and size and position of the cirrus sac.

Host : *Gadusia chapra* (Ham).
Location : Intestine.
Locality : Calcutta (Local market).
Type : Holotype (No. W6701/1-on slide)
and Paratypes (Nos. W6702/1 & W6703/1-on slides) have been deposited in the National Zoological Collections at the Zoological Survey of India, Calcutta.



CLINOSTOMUM ORIENTALE. N. Sp.

INDIAN J. HELMINTHOL. 19(2):183-187

CLINOSTOMUM MASTACEMBELI, JAISWAL 1957

(Fig. 1.)

HOST : *Notopterus notopterus* (Pallas).

LOCATION : Intestine.

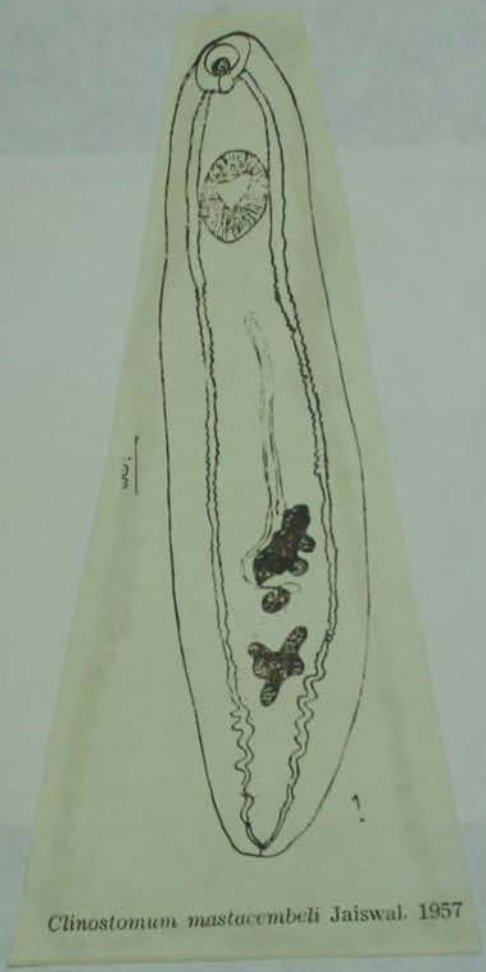
LOCALITY : Kalri lake (Sind) Area (West Pakistan).

NUMBER OF SPECIMEN EXAMINED : 5.

NUMBER OF HOST EXAMINED : 4.

Metacercariae were creamy white in colour when alive. Body aspinous, stout, lenguiform convex dorsally and concave ventrally measuring 14.37—15.00 mm long maximum. Breadth at testicular region 4.37—4.62 mm. Fore-body measures 1.56—1.68 mm in length. Oral sucker subterminal, poorly developed, measuring 0.31—0.32 mm in diameter. Pharynx small, Esophagus not distinct, Ceca with sinous wall ; opening into excretory vesicle by a narrow passage posteriorly. Acetabulum in anterior third of the body measuring 1.43—1.56 mm in length, 1.56—1.62 mm in width. Suckers ratio 1 : 3.1—1 : 4.1. Testes in posterior half of the body 3—5, lobed, measuring 0.93—1.00 mm long, 1.25—1.56 mm wide. Cirrus pouch small anterior to anterior testes. Genital atrium in front of anterior testes. Ovary on right of medium line between two testes 0.31—0.32 mm in length, 0.62—0.63 mm in width. Uterus long terminating at a distance of 1.25—1.31 mm from the acetabulum. Vitellaria confined to hind body. Excretory plexus extending in peripheral parenchyma. Excretory vesicle small and V shaped, in between the ceca. There are nodes and lesion are present in site of infection in intestine.

FATIMA MUJIB BILQEES, 1972



Clinostomum mastacembeli Jaiswal. 1957

1. Clinostomum phalacrocoracis ~~nov. spec.~~ Dubois, 1930

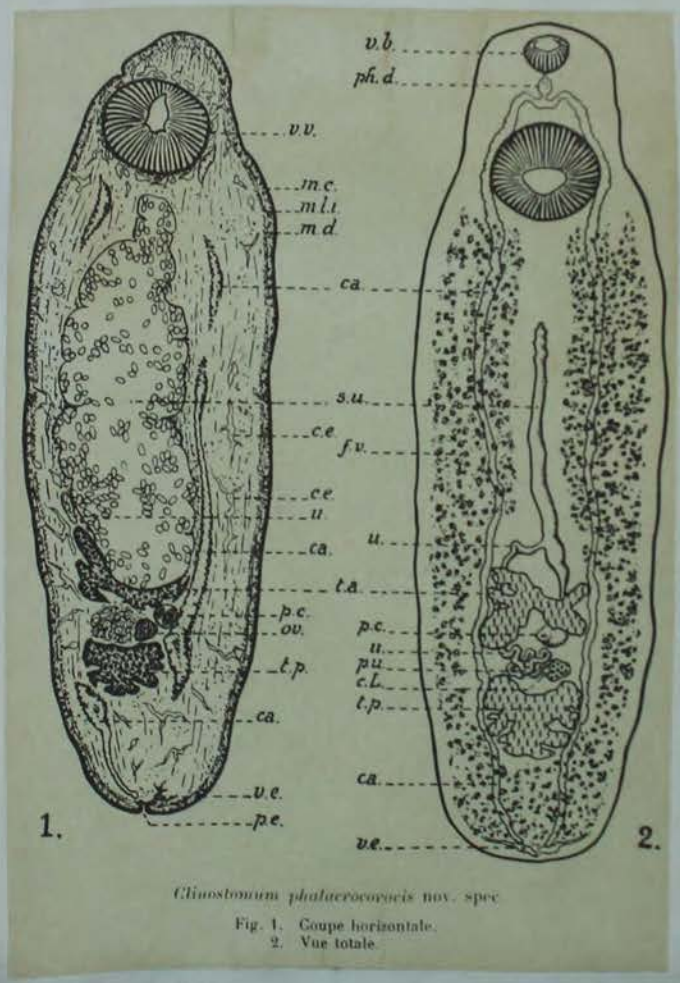
(Avec 12 figures.)

Cette espèce a été trouvée chez *Phalacrocorax Levaillanti*. Angola.

Morphologie. — Le corps, aplati ou légèrement concave ventralement, fortement convexe dorsalement, mesure 11 mm. de long. Sa largeur maximum 3mm,6 à 3mm,9 se mesure un peu en avant du milieu. Il existe une constriction très marquée à la hauteur de la ventouse ventrale, ce qui réduit le diamètre transversal à 2mm,25 à ce niveau. La hauteur (épaisseur) est de 2 mm. Les deux extrémités sont largement arrondies. La région du cou est donc beaucoup plus étroite que le reste du corps.

Ventouses. — La ventouse buccale a un diamètre transversal de 600-660 μ et un diamètre antéro-postérieur de 480 μ.

La ventouse ventrale, beaucoup plus grande et très musculeuse, mesure 1400-1560 μ de diamètre transversal, 1200-1260 μ de dia-



Clinostomum phalacrocoracis nov. spec.

Fig. 1. Coupe horizontale.
2. Vue totale.

ètre antéro-postérieur et 900-1050 μ de diamètre dorso-ventral. on centre est distant de 2 mm. de l'extrémité antérieure du corps.

Musculature. — Une des particularités caractérisant cette pèce est le développement de sa musculature. En effet, les fibres, général associées en faisceaux, forment une épaisse couche usculaire sous-cuticulaire, puis un réseau serré dans la masse parenchyme du corps ; enfin, elles constituent la paroi épaisse l'œsophage, de la poche du cirre, du cirre lui-même, du canal aculateur, du canal de Laurer, des caeca et de la vésicule excré-ce.

Sous la cuticule épaisse de 20-28 μ se trouvent quatre zones usculaires constituant avec cette dernière la paroi du corps dont paisseur varie suivant les régions de 90 à 200 μ (fig. 10) :

1° La *musculature longitudinale externe (m. l. e.)* forme, immé-tement au-dessous de la cuticule une assise unique et mince de res très fines, serrées et ondulées (diamètre 1,2 à 1,5 μ). Une rmation exceptionnelle, analogue, a été décrite par plusieurs teurs : Looss (1884) chez *Distomum reticulatum* mentionne xistence d'une couche sous-cuticulaire de fibres extraordinaire-nt fines mesurant seulement 0,9 μ ; Miestinger (1911) chez *phrocephalus sessilis* (Odhner) et Baer (1923) chez *Opistho-allus Fukrmanni* observent cette même formation musculaire.

2° La *musculature circulaire (m. c.)* constitue une puissante che de 12 à 50 μ d'épaisseur, formée de fibres isolées ou asso-en petits faisceaux et traversée par les nombreux canalicules système excréteur périphérique sous-cuticulaire.

3° La *musculature longitudinale interne (m. l. i.)* forme une e étroite, assez compacte, deux à trois fois moins épaisse que précédente. Les fibres qui la composent sont groupées en fasci-les réunis eux-mêmes en faisceaux d'une vingtaine de fibres rrées les unes contre les autres.

4° La *musculature diagonale (m. d.)* forme une couche de struc-e beaucoup plus lâche, traversée par des faisceaux obliques de à 15 fibres, distants les uns des autres.

Les espaces interfasciculaires de ces zones musculaires sont cupés par les myoblastes à noyau très chromophile.

La musculature du parenchyme est particulièrement bien déve-ppée :

1° Les *muscles longitudinaux (m. l. p.)* forment une zone d'en-on 300 μ d'épaisseur qui fait suite à la couche diagonale de la roi du corps. Les fibres s'y associent en faisceaux qui envahis-nt à peu près toute la masse du parenchyme, à part la zone ntrale occupée par les organes génitaux et limitée par les caeca.

2° Les *muscles dorso-ventraux (m. d.-v.)*, moins nombreux, sont rmés de fibres souvent groupées deux à deux et qui se ramifient leur entrée dans la musculature de la paroi du corps.

Il existe, en outre, dans la région de la vésicule excrétrice et seulement dans la moitié dorsale du corps, d'autres cellules assez rares, probablement glandulaires, isolées dans le parenchyme et dont l'aspect rappelle beaucoup celui des précédentes. Leur forme est toujours arrondie ; leur diamètre mesure de 20 à 27 μ ; leur protoplasme granuleux et peu dense est faiblement coloré et leur noyau mesure 5-3,5 μ.

Système digestif. — La bouche, subterminale, est située au centre du champ buccal orienté obliquement et mesurant environ 600 μ de diamètre. L'œsophage (diamètre 25-30 μ), au-dessus duquel passe la commissure cérébrale, s'ouvre au fond de la ventouse buccale, s'élargit dans sa moitié distale en formant une cavité ovoïde de 80 à 100 μ de diamètre transversal, puis se rétrécit assez brusquement avant sa bifurcation. Dans toute sa longueur, il est tapissé par la cuticule (fig. 9).

Le pharynx, chez cette espèce, a subi une régression presque totale (fig. 9). Il ne subsiste de cet organe que des vestiges de fibres très fines, radiales pour la plupart, formant autour de l'œsophage, à peu près au milieu de sa longueur, un amas annulaire qui refoule brusquement les myoblastes dans le parenchyme périphérique. Nous avons observé une structure analogue chez *Clinostomum chrysichthys* (1929) (fig. 14). D'après Looss (1884), chez *Distomum reticulatum* qui est un Clinostomidae du même type (disposition caractéristique des organes sexuels ; intestin avec petits diverticules sacciformes ; système excréteur abondamment ramifié avec réseau périphérique), le pharynx manque complètement. Braun (1901), dans sa monographie des espèces du genre Clinostomum, conclut, à la suite de nombreuses recherches d'après des préparations totales et des coupes, qu'un véritable pharynx manque chez les Clinostomes. L'opinion de Braun semble se trouver vérifiée dans la majorité des cas. Cependant, nous croyons pouvoir en modifier l'expression en nous basant sur les résultats de notre précédente étude de *Clinostomum Clarias* (1929). Chez cette espèce, le pharynx est normal, musculeux et plus nettement délimité même que la ventouse (fig. 13). Cette forme est voisine de *Clinostomum heterostomum* (Rud.), toutes deux étant caractérisées par la présence de longs diverticules sur le côté externe des caeca et appartenant au nouveau genre *Euclinostomum* créé récemment par Travassos (1929). Or, au sujet de cette dernière espèce, Braun dit textuellement ceci : Vom Oesophagus habe ich immer nur die wie ein Pharynx erscheinende Einmündung an der Gabelstelle des Darmes gesehen ». Tenant compte des opinions ci-dessus mentionnées, nous croyons que le pharynx des Clinostomes, primitivement bien développé, a subi une régression plus ou moins complète et que la présence de cet organe, chez beaucoup d'espèces, n'est plus attestée que par un amas de fibres entourant l'œsophage.

Dès la bifurcation de l'intestin, la cuticule qui tapissait la ven-

touse buccale et l'œsophage, est remplacée par un épithélium ou plutôt par un syncitium, car les limites cellulaires ne sont pas apparentes. Les noyaux (diamètre 2 à 3,5 μ), très chromophiles, sont arrondis, elliptiques ou lenticulaires et assez rapprochés les uns des autres. Le protoplasme émet de nombreux appendices filiformes, amœboïdes, longs de 15 μ en moyenne, dirigés vers la lumière du canal intestinal et analogues à ceux que Buttel-Reepen a décrit chez *Distomum ampullaceum*.

Les caeca, larges de 150 à 360 μ, divergent au niveau de la ventouse ventrale, puis suivent parallèlement les bords du corps pour devenir tangents aux lobes des deux testicules et se terminer à peu de distance de l'extrémité postérieure, exactement au niveau de la vésicule excrétrice. Sur toute leur longueur, ils forment de petits diverticules sur le côté interne et sur le côté externe et possèdent une musculature propre formée de muscles circulaires et de muscles longitudinaux (voir coupes transversales, fig. 3-7).

Système excréteur. — La vésicule excrétrice bicorne est située à l'extrémité postérieure du corps, de laquelle le pore dorsal subterminal est distant de 180 μ. L'orifice excréteur et la partie centrale sont tapissés par la cuticule. Les deux cornes possèdent un épithélium cylindrique à protoplasme granuleux, coloré en rouge violacé. Les cellules contiennent plusieurs vacuoles hyalines et un noyau très chromophile, sphérique ou ovoïde de 2 à 3 μ de diamètre. Enfin, la vésicule est limitée par une couche musculaire au delà de laquelle se trouvent les myoblastes amassés dans le parenchyme périphérique. De l'extrémité de chaque corne s'échappe un tronc excréteur principal qui remonte latéralement et extérieurement par rapport au caecum et dont les ramifications pénètrent toute la masse du parenchyme et sont particulièrement nombreuses au voisinage des glandes génitales. Les canaux principaux présentent de longues touffes de cils à la base desquelles s'observe un noyau aplati. Les ramifications extrêmes pénètrent dans la couche musculaire de la paroi du corps où elles s'étalent pour former un réseau périphérique et serré de très fins canalicules dans la zone des muscles circulaires.

Système génital. — Le champ des glandes génitales (Genitaldrüsenfeld de Braun), limité par les caeca, se trouve dans le dernier tiers du corps (fig. 1 et 2).

Les deux testicules sont assez profondément lobés. Leurs dimensions sont résumées dans le tableau suivant :

	Testicule antérieur	Testicule postérieur
Diamètre transversal . . .	1500 - 1800 μ	1200 - 1500 μ
Diamètre antéro-postérieur .	1000 - 1050 μ	840 - 1050 μ
Diamètre dorso-ventral . . .	750 - 900 μ	660 - 800 μ

Le testicule antérieur, de forme irrégulière, asymétrique (fig. 1 et 2), plus développé du côté gauche, comme cela s'observe en général chez les Clinostomes, subit, chez l'animal adulte, des déformations causées par la pression qu'exerce, sur cet organe, l'utérus bourré d'œufs : l'axe transversal du testicule devient fortement concave et ses lobes s'étirent suivant une direction oblique (fig. 1).

Le testicule postérieur, plus régulier, en forme de coquille ou d'éventail, présente deux lobes latéraux-antérieurs et un lobe médian-postérieur, tous trois divisés à leur tour en lobes secondaires.

Les deux vasa efferentia se réunissent très près de la poche du cirre ; le vas deferens est très court, de ce fait (fig. 8 et 11).

La poche du cirre, allongée dans un plan sagittal et recourbée au milieu de sa longueur, occupe une position latérale, à droite de la ligne médiane, du même côté que l'ovaire par rapport auquel elle est ventrale (fig. 7), un peu antérieure et légèrement latérale (fig. 1). Elle est donc située entre les deux testicules, mais plus proche du testicule antérieur (fig. 2). Son diamètre transversal qui augmente du niveau du cirre à celui de la vésicule séminale, varie de 150 à 450 μ. Elle est limitée par une forte couche musculaire de 12 μ d'épaisseur formée de muscles longitudinaux externes constituant une assise de 10 μ et de muscles circulaires internes (épaisseur 2 μ). Le tissu conjonctif englobe 1° une grande vésicule séminale occupant le tiers de l'organe, possédant sa musculature propre et un épithélium sans limites cellulaires visibles, à noyaux ovales (diamètre 5 à 6,8 μ / 3,5 à 4,2 μ) contenant un gros nucléole, 2° le canal éjaculateur très musculeux (voir fig. 11), avec myoblastes périphériques et cuticule interne, qui aboutit après avoir décrit plusieurs boucles au cirre également très musculeux (abondance de myoblastes dans le parenchyme de la poche) et caractérisé par d'énormes papilles cuticulaires, de structure homogène.

Le pore génital se trouve au niveau du bord postérieur du testicule antérieur, un peu à gauche de la ligne médiane.

L'ovaire, latéral, situé à droite entre les deux testicules, dorsal par rapport à la poche du cirre située du même côté (ce qui explique l'asymétrie du testicule antérieur, fait que nous avions déjà observé chez *Clinostomum Clarias* et chez *Clinostomum chrysichthys*), est massif, mais de petites dimensions :

Diamètre transversal	330 - 420 μ
Diamètre antéro-postérieur . .	300 - 350 μ
Diamètre dorso-ventral	360 - 420 μ

L'oviducte (diamètre 20 μ) est revêtu d'un épithélium à protoplasme chromophile et très finement granuleux et à petits noyaux arrondis ou ovales (diamètre 2,5 à 3,5 μ). Il est limité par une mince couche musculaire (*od.*, fig. 12).

Le canal de Laurer (diamètre 25 μ ; 35 μ y compris sa muscu-

CLINOSTOMUM PHALACROCORACIS DUBOIS, 1930 (CONT.)

lature propre) qui débouche dorsalement, est tapissé par une cuticule de 5 à 6 μ d'épaisseur, refoulant les débris de l'ancien épithélium embryonnaire. Il possède une forte paroi musculaire de 4 à 5 μ d'épaisseur avec myoblastes dont les noyaux très chromophiles se voient distinctement à la périphérie (fig. 12).

La glande coquillère, assez peu développée, se trouve à gauche de la ligne médiane ; elle est dorsale par rapport au peloton de l'utérus (fig. 6). Ce dernier est une masse ovoïde de 1^{mm}-1^{mm},05 / 0^{mm},90-0^{mm},96 de diamètre, formée des premières boucles utérines, comprises entre les deux testicules, tangente d'un côté à l'ovaire, de l'autre au caecum gauche et sur laquelle se moule la glande coquillère (fig. 6 et 7). De ce peloton s'échappe, à gauche, la branche ascendante de l'utérus (*u*, fig. 1, 2 et 6) qui passe sous les lobes latéraux du testicule antérieur, puis se jette dans le sac utérin. Celui-ci se présente différemment suivant le degré de maturité de l'animal. Chez les adultes dont l'utérus ne contient pas encore d'œufs, il a la forme d'un long tube de 200 à 270 μ de diamètre, occupant l'axe longitudinal du corps et se terminant en cul-de-sac à 1^{mm},35 du bord postérieur de la ventouse ventrale (fig. 2). Chez les individus tout à fait mûrs, il apparaît comme un énorme sac bourré d'œufs, mesurant 5^{mm},5 à 6 mm. de longueur et 1 mm. à 1^{mm},6 de largeur et s'étendant jusqu'à 210-300 μ du bord postérieur de la ventouse ventrale. En arrière, il refoule même le testicule antérieur dont l'axe transversal devient fortement concave (fig. 1).

Les follicules vitellogènes s'étendent de chaque côté du corps (dorsalement, latéralement et ventralement) de l'extrémité postérieure jusqu'au niveau du bord postérieur de la ventouse ventrale (fig. 2 et coupes transversales).

Les œufs dont l'embryon apparaît sous forme d'un amas cellulaire, mesurent en moyenne 117 μ / 72 μ.

Hôte. — *Phalacrocorax Levaillanti.*

Lieu. — Afrique (Angola).

L'espèce que nous venons de décrire se rapproche, par plusieurs caractères de *Clinostomum detruncatum* de *Mycteria americana* décrit par Braun ; la forme du corps et la topographie des organes sexuels sont peu différentes.

Cependant, *Clinostomum phalacrocoracis* présente deux caractères morphologiques spécifiques : le rétrécissement très marqué au niveau de la ventouse ventrale qui diminue considérablement la largeur de la région du cou et le grand diamètre dorso-ventral du corps qui atteint 2 mm.

Clinostomum detruncatum est une forme qui, pouvant atteindre 14 mm., paraît un peu plus grande et plus élancée (largeur 3 mm. pour les exemplaires les plus longs). Sa ventouse buccale est plus petite (0^{mm},3-0^{mm},4) de même que sa ventouse ventrale qui mesure 1^{mm}-1^{mm},5. Les testicules sont aussi irrégulièrement lobés (le postérieur étant le plus volumineux) et délimitent l'un et l'autre, par leurs bords opposés concaves, un espace occupé par l'ovaire et le peloton utérin. Le pore génital est situé au niveau du bord antérieur du testicule antérieur tandis que chez *Clinostomum phalacrocoracis*, il se trouve à la hauteur du bord postérieur du même testicule, c'est-à-dire très peu en avant de l'ovaire. La situation de la poche du cirre est différente, de ce fait. En outre, la disposition des follicules vitellogènes n'est pas absolument la même. Les œufs mesurent 110 μ / 62 μ.

Cette comparaison établit la proche parenté des deux espèces sans toutefois permettre de les identifier. (Comparer fig. 2 avec la fig. 11, tableau 2, de Braun.)

Clinostomum phalacrocoracis Dubois, 1930.

Longueur: 11^{mm}; largeur maxima: 3^{mm},6 à 3^{mm},9.

La ventouse orale mesure 0^{mm},6 à 0^{mm},7 sur 0^{mm},5. Il existe un pharynx dégénéré. La ventouse ventrale a 1^{mm},4 à 1^{mm},6 sur 1^{mm},2 à 1^{mm},3. Les glandes génitales se trouvent dans le tiers postérieur du Ver. Le pore sexuel est situé entre les deux testicules, en avant de l'ovaire. L'utéroducte débouche dans le quart inférieur de l'utérus. Ce dernier atteint la ventouse ventrale lorsqu'il est rempli d'œufs. Les glandes vitellogènes confluent en arrière des testicules et s'étendent jusqu'au bord postérieur de la ventouse ventrale. Les œufs ont 117 μ de long et 72 μ de diamètre. Adulte chez *Phalacrocorax levaillanti* (Licht.) = *Plotus rufus* Lacép. et Daud. Développement inconnu.

From Baer, 1933

[illegible] *phalacrocoracis* Dubois, 1931 [illegible] Lacépède & Daudin, whole mount

From esoph. *Anhinga r. rufa* (Lac. + Daudin); coll. near Accra, Ghana. See reprint: Ukoli (1966).

Clinostomum philippinensis Velasquez, 1960

Metacercariae in Ophicephalus striatus (just outside eyeball; between branchiostegal muscles; lining of pericardial and opercular cavities.

Adults experimentally in Nycticorax nycticorax nycticorax
Nyctocorax caledonicus manillensis

CLINOSTOMUM PHILIPPINENSIS sp. nov.

Metacercariæ and adult elongate, linguiform, narrower anteriorly than posteriorly (Plate 1, figs. 3 and 4; Plate 2, fig. 1). Principal measurements are given in Table 3. Cuticle about 6.6 to 13.2 microns thick with minute spines throughout entire length of body. Under this is a well developed muscular layer made up of (*1*) a very thin layer of external longitudinal muscles, (*2*) immediately under the preceding is a layer of circular muscles, (*3*) an internal compact layer of longitudinal

TABLE 3.—*Measurements of twenty-five mounted specimens of metacercariæ and ten adults of Clinostomum philippinensis sp. nov.*

Part of the specimens	Minimum		Maximum		Average	
	Metacercaria	Adult	Metacercaria	Adult	Metacercaria	Adult
BODY	mm	mm	mm	mm	mm	mm
Total length	2.5	4.1	12.5	7.9	8.072	5.62
Maximum width	1.0	1.5	3.95	3.0	2.626	2.62
Total length:						
Maximum width	2.5	2.733	3.164	2.633	3.074	2.221
Distance of posterior edge of acetabulum to anterior edge of ovary	1.065	1.38	4.845	3.105	2.678	2.013
Distance of posterior edge of acetabulum to anterior tip of uterus	0.225	0.18	0.75	0.45	0.496	0.34
Precetabular length:						
Total length of body	0.141	0.156	0.246	0.248	0.175	0.194
ORAL SUCKER						
Antero-posterior length	0.120	0.27	0.570	0.45	0.370	0.367
Maximum diameter	0.225	0.345	0.870	0.510	0.504	0.432
Acetabulum Antero-posterior length	0.69	0.81	1.56	1.23	1.158	0.972
Maximum diameter	0.675	0.84	1.68	1.20	1.152	0.969
TESTIS						
Ta *						
Maximum length	0.3	0.45	1.275	0.93	0.762	0.657
Maximum width	0.375	0.495	1.275	1.35	0.805	1.043
Tp *						
Maximum length	0.24	0.48	1.02	0.795	0.583	0.618
Maximum width	0.405	0.63	1.65	1.53	0.972	1.167
OVARY						
Maximum diameter	0.075	0.15	0.30	0.345	0.18	0.195

* Ta, anterior testis; Tp, posterior testis.

muscles, and (*4*) a loosely packed layer of diagonal muscles (Plate 3, figs. 1 and 2; Plate 4, figs. 2 and 4). The external longitudinal muscle layer measures 0.99 to 3.3 microns, while the circular muscle layer measures 23.1 to 52.8 microns in thickness. Among the muscle fibers are numerous peripheral excretory canals of the reserve excretory system which are larger posteriorly than anteriorly. The internal longitudinal muscle layer is rather compact and not loosely arranged as the preceding and is about 16.5 to 33 microns thick while the diagonal muscle layer is made up of loosely packed fibers forming bundles of about 6.6 to 13.2 microns. In between the muscle bundles are myoblasts, rather deeply stained as compared to the neighboring muscle bundles. The parenchymal muscles are made up of longitudinal muscle fibers of several layers, widely spaced and occupying the entire length of the body except those occupied by the intestinal cæca, the genital organs and the vitellaria; and the dorsoventral muscle fibers which are less numerous with fewer fibers grouped together ramifying towards the outer part of the body.

1

Cells believed to be glandular in nature, similar to those found in *Clinostomum chrysichthys* Dubois(4) and *C. phalacrocoracis* Dubois(5) were also noted in *Clinostomum philippinensis* sp. nov. as shown in Plate 3, figs. 1 and 2. The classification of gland cells is that of Dubois.(4, 5)

The measurements of the cells are:

Kind of cell	Length and diameter of cell	Diameter of nucleus
Cells	*Microns*	*Microns*
Preacetabular glandular	18.5 to 36.3 by 14.85 to 17.5	2.64 to 4.95
Colorless glandular	16.5 to 29.4 by 13.2 to 19.8	3.3
Eosinphilic glandular	16.5 to 26.4 by 13.2 to 19.8	3.3

The preacetabular glandular cells are larger than the other gland cells and have finely granular cytoplasm usually with a rather eccentrically located nucleus with a distinct nuclear membrane. The eosinophilic glandular cells are more deeply stained in Delafield's hematoxylin than the other cells although the nucleus is not so deeply stained in eosin as those described by Dubois.(4, 5) The colorless glandular cells are coarsely granulated and smaller than the preacetabular ones and almost of the same size as the eosinophilic cells, and are more numerous towards the area just below the internal longitudinal muscles.

Oral sucker subterminal or ventro-terminal partially retracted, about one half the size of the acetabulum, acetabulum highly muscular, at anterior third of body; pharynx and esophagus hardly discernible; intestinal crura extend laterally a little beyond the oral field and then posteriorly almost the entire length of the body, and are wider and more deeply diverticulate externally and internally in the postacetabular region (Plate 1, figs. 3 and 4; Plate 2, fig. 1), uniting at their distal ends to the two horns of the excretory vesicle (Plate 3, fig. 3).

Histological preparations show that the intestinal caeca are lined by deeply stained columnar cells. (Plate 3, figs. 1, 2, 3, and 4)

Excretory vesicle bicornuate, Y-shaped, opening through a pore at postero-dorsal end of body. Lateral branches ramify anteriorly into smaller ones towards the peripheral region of body (Plate 3, figs. 3 and 4).

Genital organs are median occupying the posterior third of body. Testes coarsely lobed, with the slightly concave and smooth surface facing each other. Anterior testis asymmetrical, more or less triangular, with the right side pointed and not as lobed as the left side. This condition is rather more marked in the metacercaria than in adults. Posterior testis with a wide posterior lobe and two lateral lobes. Cirrus pouch, 0.57 to 0.43 mm by 0.2 mm, enclosing a coiled vesicula seminalis filled with spermatozoa and continuing to a narrow convoluted rather muscular ejaculatory duct connected with the muscular cirrus opening into the genital atrium (Plate 4, figs. 1 and 3). Pars prostatica short, surrounded by prostate cells. Ovary more or less rounded, located between the two testes and towards the right. Arising from the ovary is the oviduct directed towards the left and uniting with the Laurer's canal which opens to the dorsal side of the worm; a little beyond this junction is the vitelline reservoir formed by the union of the two vitelline ducts, meeting at about the same level as the ötotype complex. Beyond the ötotype are coils of the uterine duct winding through the large diffuse Mehli's gland and some of its coils serving as receptaculum uterinum. Then the uterine duct passes to the right anteriorly beyond the anterior testis to the uterine sac. The latter measures 0.098 to 0.122 by 0.056 to 0.083 mm, and is at times greatly enlarged when filled with eggs. At the lower right side of the uterine sac arises a funnel-shaped structure set almost at right angles to the wall of the sac. This funnel-like structure contracts into a narrow direct passage, the weakly muscled metraterm. The latter discharges into the genital atrium (Plate 2, fig. 1; Plate 4, figs. 1 and 3). The main uterine sac is diverticulate (Plate 4, fig. 1). Eggs measure 0.098 to 0.122 mm by 0.056 to 0.083 mm.

Vitellaria follicular, rounded or elliptical and generally grouped together, postacetabular, intracecal and extracecal and reaching the posterior limit of the intestinal caeca (Plate 1, fig. 4; Plate 2, fig. 1).

Clinostomum philippinensis (continued)

The available literature describes six larval forms from fish of non-local source; namely, *Clinostomum dictyotum* (Monticelli, 1893) [Syn. *Distomum reticulatum* Looss, 1885, nec Wright, 1897, *Clinostomatopsis reticulata* (Looss) Dollfus, 1932]; *C. marginatum* (Rudolphi, 1809); *C. complanatum* (Rud., 1809); *C. erysichthys* Dubois, 1929; *C. piscidium* Southwell et Prashad, 1918; *C. africanum* Galli Valerio, 1906; and two Philippine larval forms, from *Ophicephalus striatus*: namely, *C. dalagi* Tubangui 1933 and *C. ophicephali* Tubangui and Masilungan, 1944.

C. philippinensis sp. nov. is easily distinguished from *C. dictyotum* by the longer metraterm; the position of the genital atrium and the nature of the intestinal cæca. *C. philippinensis* is distinguished from *C. marginatum* Rud., 1819 as described by Yamaguti(22) by the shape of the testes and the longer uterine sac in the metacercaria; from *C. pseudum* by the bigger size of the oral sucker and the position of the genital organs. The description of *C. africanum* is inadequate and thus proper comparison is not deemed possible. From *C. ophicephali* the present species differs in shape as well as the more anterior position of the genital organs and the much shorter uterus. According to Tubangui and Masilungan *C. ophicephali* is slipper-shaped, rather small, 2 to 11 mm with genital organs almost at posterior end of the body. The new species is relatively larger (Table 3) and genital organs are median in the posterior third of the body. The shape of the testes and of the uterus is distinctly different in the two species. Although the average length of *C. philippinensis* sp. nov. is almost twice that of *C. dalagi* yet the latter species falls within the range between the maximum and minimum of that of the new species. However, the average width is rather close in the two species. Since there is a great variation in size, it cannot be a very good criterion in the differentiation between the two species. It is also noted that the metacercariæ are relatively longer than the adult forms in *C. philippinensis* sp. nov., which was also found to be true in *C. complanatum* (Rud., 1809) Yamaguti.(22) Although the nature of the cæcal diverticula and the uterus of the new species is similar to that of *C. dalagi*, yet the shape of the testes is distinctly different; the testes are lobed and triangular while those of *C. dalagi* are pyramidal, smooth and not lobed.

Clinostomum abdoni Tubangui and Garcia(20) from the cat is the first and only adult ever described in the Philippines. *C. philippinensis* sp. nov. from the bird is the second to be described. It is easily distinguishable from *C. abdoni* by the body shape, and less distended uterine sac and more anterior position of the genital organs; from *C. complanatum* (Rud., 1819) as described by Braun(2) and Yamaguti,(22) it is slightly longer, but the shape of the body, position of the genital organs and genital atrium approaches those of the Japanese specimens. Although the shape of the testes in the illustration is surprisingly similar to that of Yamaguti's yet several specimens had their anterior testis definitely triangular. In all cases, however, the extent of the vitellaria and the diverticula of the uterine sac as shown histologically and the nature of the cæcal diverticula differ from those of Yamaguti's or that of Braun and the eggs are smaller. *C. intermedialis* Lamont is similar to the new species in the postacetabular diverticula of the intestinal cæca, the shape of the testes and extent of the vitellaria. *C. intermedialis* is, however, distinguishable from the new species by the presence of a more prominent pharynx (although Price(17) in his redescription of *C. intermedialis* had doubts of its existence), extent of the uterus as in Price's redescription and the sparseness of the vitellaria.

From the results of the feeding experiments, the definitive hosts are *Nycticorax nycticorax nycticorax* (Linn.) and *Nycticorax caledonicus manillensis* Vigors. However, *Ixobrychus cinnamomeus* Gmelin can be infected, but with difficulty.

Type and paratypes: Dept. of Zoology, University of the Philippines, Helm. Coll. Nos. 156, 206, and 302.

In an Addendum Velasquez comapres this species with Clinostomum macrocosm Jaiswal,1957

It differs in "realtive size of body, relative size of anterior and posterior suckers, relative position of the ovary and genital pore and in the character and extent of the vitellaria.

Jaiswal did not show a pharynx. In C.philippinensis the pPharynx is barely visible.

Clinostomum piscidium Southwell & Prashad, 1918

A few specimens obtained from the body cavity of *Nandus nandus* from Poona were available for study. These on examination proved to be *Clinostomum piscidium* (Southwell and Prashad, 1918). A few observations made on a single mounted specimen are recorded below:

The body is thick, fleshy and measures 3·5 mm. long and 1·96 mm. in maximum breadth which is attained in the testicular region. The oral sucker measures 0·18 mm. in diameter. The acetabulum measures 0·6 × 0·48 mm. The gonads are situated immediately behind the middle of the body. The cirrus sac is situated on the right side of the anterior testis, is slightly curved and measures 0·35 mm. in length. The genital pore is

situated on a level with the anterior margin of the anterior testis. The uterus extends anteriorly almost as far as the posterior border of the acetabulum. The utero-duct joins the uterus slightly in front of the anterior testis. In the original description the pharynx is said to have been absent but in the specimen under examination a small pharynx was found to be present. The tendency for the retraction of the anterior end of the body bearing the oral sucker is usual. There is also a tendency for both the ends of the body and the sides to retrovert ventrally.

FROM BHALERAO, 1942

Clinostomum piscidium Southwell et Prashad, 1918.

Longueur: 2mm,8 à 5mm; largeur maxima: 1mm,4 à 1mm,8.

Les auteurs n'ayant pas donné d'autres mesures de leur larve nous les avons évaluées d'après l'échelle donnée. La ventouse orale est environ la moitié plus petite que la ventouse ventrale. Les glandes génitales sont médianes et la poche du cirre paraît très grande; elle débouche en dehors de la ligne médiane au niveau du testicule antérieur. Les glandes vitellogènes sont disposées latéralement entre

les organes génitaux et l'extrémité postérieure du Ver. Enkystées dans le mésentère de *Trichogaster fasciatus* Bl. Sch. et de *Nandus nandus* (C. V.). Ceylan.

From Baer, 1933

Clinostomum prashadi ~~n. sp.~~ BHALERAO, 1942

Numerous specimens obtained from an unidentified fish and deposited in the collection of the Central Research Institute, Kasauli, were sent to the writer for identification.

The worms are elongate and thin, with the anterior end and the sides bent ventrally. They measure 3·6–4·73 mm. in length and 1·3–1·77 mm. in maximum breadth which is attained in the region of the gonads. The mouth is subterminal and is surrounded by the oral sucker measuring 0·17–0·19 × 0·18–0·215 mm. The prepharynx is 0·028 mm. long and the pharynx measures 0·4 mm. in diameter. The intestinal cæca are simple and terminate near the posterior end of the body. The ventral sucker is situated at about the anterior fourth of the body and measures 0·65–0·68 × 0·52–0·56 mm., being about three times larger than the oral sucker. The excretory pore is situated at the posterior end of the body.

The gonads are situated in the third quarter of the body. The anterior testis is somewhat irregularly lobed and it measures 0·335 × 0·35 mm. The posterior testis is Y-shaped and measures 0·245 × 0·29 mm. The cirrus sac measures 0·41 × 0·09 mm. and is situated on the right side of the anterior testis. It contains the vesicula seminalis, the pars prostatica and the ductus ejaculatorius. The pars prostatica is surrounded by the prostatic cells. The genital pore is situated at the anterior border of the anterior testis.

The ovary is irregularly lobed, measures 0·085 × 0·075 mm. and lies posterior to the cirrus sac. The uterine sac terminates immediately behind the ventral sucker. The utero-duct joins the uterine sac close in front of the anterior testis. The metraterm is 0·135 mm. long. The vitellaria extend from the posterior border of the ventral sucker to the ends of the intestinal cæca.

Among the metacercarial forms recorded so far, the present species resembles *Clinostomum piscidium* Southwell and Prashad, 1918. It, however, differs from *C. piscidium* in the position of the gonads in the body, in the extent of the vitellaria and in the ratio of the oral to the ventral sucker. Moreover, the present form is thin and very much elongated in shape. It is, therefore, proposed to regard it as a new species for which the name *Clinostomum prashadi* is proposed in honour of Dr. Baini Prashad.

Clinostomum progonum n. sp. Jaiswal, 1957

In December, 1952, seven Skating Frogs, *Rana cyanophlyctis*, were autopsied, and out of these one was found to harbour in the buccal cavity a solitary specimen of this new metacercaria.

The distome is fairly thin, measuring 3.0 mm. in length and 1.2 mm. in maximum width, which is attained at about the equatorial level of the body. The anterior and the posterior ends are broadly rounded. The integument has a close set coating of backwardly directed spines. The oral sucker is subterminal and oval in outline, measuring 0.30 by 0.23 mm. and is surrounded by a distinct oral field, as shown in fig. 7. The acetabulum is well-developed and is almost rounded in shape, measuring 0.5 by 0.46 mm. It is situated at about $\frac{1}{4}$th of the body length from the head-end and closely bounded laterally by the intestinal crura. The two suckers are 0.41 mm. apart and their size ratio is 1 : 1.7.

The mouth is surrounded by the oral sucker and leads directly into a short oesophagus 0.11 mm. long. The pharynx is lacking, which is one of the characteristic features of the genus. The oesophagus bifurcates into two long and much swollen intestinal caeca which run posteriorly in a sinuous course, their blind ends terminating caudally. The tips of the caeca lie immediately in front of the cornua of the excretory bladder. The sacculated condition of the caecal walls is a prominent feature of the worm.

The excretory bladder is in the form of a short Y, which opens to the exterior at the median and subterminal excretory pore.

The testes are broader than long with irregular margins, measuring 0.28 by 0.12 mm. and 0.3 by 0.11 mm. respectively. They are placed anterior to the middle of the post-acetabular portion of the body and in this respect differ from all the species so far described. The cirrus sac is pear-shaped and is placed on the right side of the ovary between it and the intestinal caecum. It encloses a coiled vesicula seminalis, ductus ejaculatorius, and the cirrus.

Fig. 7. *Clinostomum progonum* n. sp. Ventral View.

The ovary is rounded in shape, situated immediately in front of the right hand corner of the posterior testis and measures 0.09 mm. in diameter. The oviduct arises from the inner margin of the ovary and the uterus on emerging from the shell-gland forms the utero-duct. This curves round the anterior testis to open into a rectangular uterine sac, measuring 0.33 by 0.14 mm. The metraterm arises from the uterine sac at the level at which the utero-duct joins the latter on the opposite side. The opening of the metraterm is quite close to that of the cirrus pouch, at about the mid-level of the anterior testis. The genital atrium was not discernible even under high magnification.

The vitellaria consist of small rounded follicles, terminating a little in front of the caudal end and anteriorly extending into the acetabular region.

Discussion: Earliest record of metacercaria from amphibian hosts is that of *C. complanatum* (Syn. *Distoma gracile*) recorded by MacCallum in 1895 from cysts in the muscles of frog. Osborn (1911) described *C. marginatum* from cysts in the frog which subsequently was shown to be synonym of *C. complanatum*. Cort (1912) described *C. attenuatum* from cysts found in the mesenteries and under peritoneum of *Rana pipiens* in Indiana. Later Tubangui (1933) published the account of a new metacercaria *C. pseudoheterostomum* from *Rana magna* in Philippines. The metacercaria described in this paper differs from the known forms in the anterior position of the gonads. It is allied to *C. schizothoraxi* Kaw 1950, from which it can be distinguished by the character of the testes and the uterine sac, by the presence of prominent vitelline follicles and also by the general shape and size of the body.

-OVER-

The new metacercarial form recovered from the frog is proposed to be named *Clinostomum progonum*.

Specific diagnosis: Body 3.0 by 1.2 mm.; suckers unequal, oral sucker 0.30 by 0.23 mm. surrounded by an oral field; acetabulum 0.5 by 0.46 mm. intestinal caeca much distended, sacculated posteriorly, the blind tips much swollen. Testes with irregular margins, placed anterior to middle of postacetabular portion of body, anterior testis 0.28 by 0.12 mm. and posterior 0.3 by 0.11 mm. Ovary rounded 0.09 mm. in diameter placed nearer to hind testis.

Host: *Rana cyanophlyctis*.
Habitat: Buccal Cavity.
Locality: Hyderabad State.

The type specimen is deposited in the Zoological Museum of the Osmania University

Clinostomum pseudoheterostomum Tubangui, 1933

Two individuals of this parasite were presented by Dr. D. Villadolid, of the College of Agriculture, University of the Philippines, Los Baños, who found them encysted between the femoral muscles of a frog. The fluke is characterized by the form of its testes, the anterior testis being U-shaped and the posterior V-shaped. In this respect it is similar to the adult Clinostomum heterostomum (Rudolphi), as described by Braun (1900). A detailed comparison between the two forms, however, cannot be made, for a description of the corresponding immature stage of the latter is not available.

Description: Body elongate, slightly tapering towards both ends, 6.6 to 7.2 by 1.8 to 2.0 millimeters in size. Cuticle apparently unarmed. Oral sucker subterminal, 0.60 to 0.64 by 0.70 to 0.80 millimeters in size; it is not retracted, hence neither collar nor oral field is visible. Acetabulum 0.98 to 1.08 by 1.10 to 1.24 millimeters in size, between anterior and middle thirds of body length. Pharynx absent; esophagus very short, practically absent. Intestinal caeca long, with short lateral branches, extend to near posterior end of body.

Testes tandem in anterior half of last third of body length; anterior testis U-shaped, measures 0.52 to 0.60 by 0.70; posterior testis V-shaped, 0.50 by 0.54 to 0.62 millimeters.

Ovary small, intertesticular, on right side of median line, 0.16 by 0.12 millimeters in size. Shell gland median, slightly larger than and lateral to ovary. Uterine sac prominent, cylindrical, median, from about 0.3 millimeters behind acetabulum to immediately in front of anterior testis. Vitellaria not evident.

Excretory pore median, on dorsal surface, near posterior end of body.

Specific diagnosis: Clinostomum: Body elongate, 6.6 to 7.2 by 1.8 to 2.0 millimeters in size. Oral sucker 0.60 to 0.64 by 0.70 to 0.80; acetabulum 0.98 to 1.08 by 1.10 to 1.24 millimeters in size, between anterior and middle thirds of body length. Testes dissimilar; anterior testis U-shaped, posterior testis V-shaped.

Host: Rana magna.

Location: Encysted between femoral muscles.

Locality: Los Baños, Laguna, Luzon.

Type specimens: Philippine Bureau of Science parasitological collection No. 22.

Family CLINOSTOMATIDAE Lühe, 1901.

Clinostomum pyriforme n. sp. Prudhoe, 1957

(Fig. 5.)

Host and locality :

From mouth of *Aonyx capensis*. Ganza, 860 m, 14.VI.1949 (2497 c). clawless otter

The body is pyriform but appears to be rather contracted in all specimens. It is smooth and measures 2,5-3,5 mm in length and 1,2-1,7 mm in width. The oral sucker is subterminal, poorly developed and measures 0,22-0,35 mm in diameter. Close behind the opening of the oral sucker the body-wall is thrown into a well-developed collar. A pharynx is apparently absent, and the oral sucker opens directly into a short oesophagus, measuring about 0,25 mm in length and lined with cuticle. The hinder region of the oesophagus is enlarged and provided with a relatively thick circular musculature. The intestinal caeca are simple, undulating dorso-ventrally and extending to the posterior end of the body. The undulation is so profuse that the anterior portions of the caeca appear to be moniliform. The caeca terminate near the base of the excretory vesicle, into which they do not appear to open, as in some other species of the genus *Clinostomum*. The ventral sucker, situated in the middle region of the body, is comparatively large, measuring 0,6-0,8 mm in diameter. The excretory pore is more or less dorsally situated near the posterior end of the body. It opens into a V-shaped excretory vesicle. The genital pore lies in the median line, near the anterior margin of the foremost testis. It leads into a narrow atrium, into which open the cirrus-sac and the metraterm. The cirrus-sac is pyriform, with its longitudinal axis disposed more or less dorso-ventrally. It lies on the anterior margin of the foremost testis and measures about 0,5 mm in length and 0,25 mm in maximum width in its proximal region, and contains a much coiled ejaculatory duct and a bipartite seminal vesicle. The ejaculatory duct is muscular and seems to be lined with a thin cuticle which may have a corrugated appearance. No pars prostatica has been observed. The testes are arranged one behind the other in the hinder quarter of the body. They are transversely-elongate organs, with the hinder margin slightly convex and the anterior margin concave, sometimes rather deeply. In all the specimens examined, the foremost testis, measuring 0,75-1 mm in transverse diameter, is shaped rather like a boomerang and constantly larger than the hinder testis, which measures 0,50-0,75 mm transversely. The ovary is situated to the right of the median line, on the

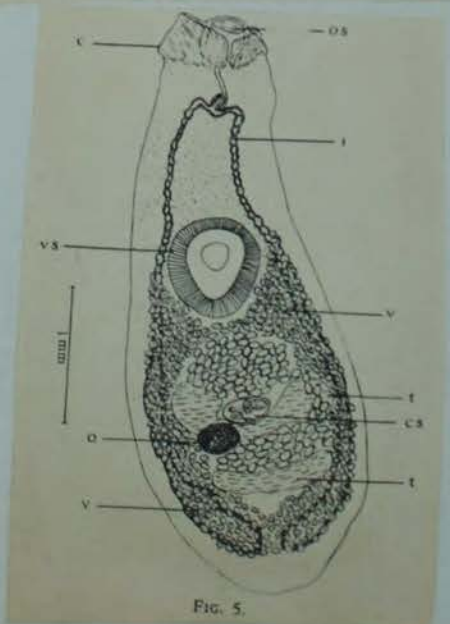


Fig. 5.

posterior margin of the anterior testis. It is transversely oval and measures 0,22-0,25 × 0,15 mm. A receptaculum seminis has not been observed, but sometimes a mass of spermatozoa may be seen in the proximal region of the uterus. Laurer's canal opens in the mid-dorsal line, posteriorly to the ovary. The oviduct is much convoluted, while the ootype is a narrow elongate structure, not very well differentiated. The ascending limb of the uterus crosses the anterior testis on the left side to open into a spacious uterine sac lying between the anterior testis and the ventral sucker. The vitellaria consist of well-developed follicles situated laterally and extending from the hinder end of the body to about the middle of the ventral sucker. Posteriorly, and often immediately behind the ventral sucker, the follicles are confluent in the median line. In specimens stained with Mayer's paracarmine and mounted in Canada balsam the eggs are collapsed and measure about 0,110 × 0,082 mm while eggs taken from unstained specimens and mounted in formalin measure 0,117-0,125 × 0,067-0,072 mm.

The form described above differs from other known species of *Clinostomum* not only in its small size, but also in the position of the cirrus-sac in relation to the anterior testis. The latter character might be regarded as generically important, but since the position of the cirrus-sac varies in different species of *Clinostomum* the writer feels that the erection of a new genus for the present form is unnecessary.

Another interesting feature of the new form is that it is the only species of *Clinostomum* so far known to occur naturally in a wild mammal. It is true that *C. complanatum* (Rud.) has been found in the pharynx of man in Japan (Yamashita, 1938) and in Tiberias (Witenberg, 1944), while *Clinostomum abdoni* Tubangui and Garcia, 1939, *Clinostomum kalappahi* Bhalerao, 1947, and *Clinostomum* sp. of Belliappa, 1944, have been recorded from under the tongue of domestic cats in the East Indies, but these infestations may be justifiably regarded as accidental and are presumed to have been derived through the consumption of raw or improperly cooked fish.

CLINOSTOMUM SCHIZOTHORAXI N. SP. Kaw, 1950

(Fig. 19 A and B)

The worm lies in a cyst on or just beneath the skin of the fish, specially at the base of fins, tail and gill covers. The cyst is nearly spherical, measuring 1.48—1.7 x 1.2—1.46 mm. Body is elongated, linguiform, moderately fleshy and 3.5—4.75 x1.0—1.66 mm. in size. Anterior portion is retractile and bears a small subterminal oral sucker, measuring 0.2—0.26 x 0.31—0.38 mm. Culticle is aspinose. Acetabulum is large, muscular and 0.58—0.68 x 0.6—0.68 mm. in size and lies at a distance of about one-fifth of the body-length from the anterior end,

Mouth is surrounded by oral sucker and leads into a prepharynx. Pharynx is globular and 0.16—0.2 mm. in dia Oesophagus is exceedingly short and proceeds vertically towards surface to bifurcate into the intestinal caeca. The int bifurcation lies at about one-eighth of the body-length fro anterior end of the body. The intestinal caeca, 0.14 mm. extend nearly upto the posterior end of the body, being con posteriorly with the excretory bladder by small ducts and generally crenated appearance behind the level of the aceta Sometimes intestinal caeca are not crenated and are inflated or both sides, being 0.3—0.4 mm. thick.

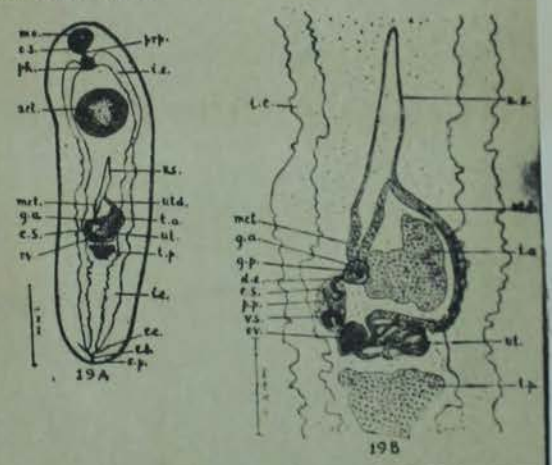


Fig. 19 *Clinostomum schizothoraxi* n. sp. A. Entire. B. Genita organs.

Gonads lie in the third quarter of the body. Testes are in slightly lobed, more or less triangular and medial in The anterior testis measures 0.18—0.3 x 0.19—0.3 mm. posterior testis 0.2—0.22 x 0.18—0.33 mm. Cirrus sac is ov 0.17—0.27 x 0.1—0.18 mm. in size and lies on the right sid anterior testis and ovary. It contains within it a coiled seminalis, well developed pars prostatica and long and coile ejaculatorius which opens into genital atrium.

Jaiswal, 1957

Clinostomum singhi n. sp.

Eight specimens of this species collected by Dr. S. N. Singh from the intestine of a Pond Heron, *Ardeola grayi*, were placed at the disposal of the writer. A detailed study of the flukes resulted in the formation of a new species of *Clinostomum*, which is described below.

This is a small fluke elongate-oval in shape with rounded ends, measuring 2.62 to 3.72 mm. in length and 1.02 to 1.31 mm. in greatest width, attained at the middle of the post-acetabular portion of the body. An attenuated anterior portion of the body is marked off by a slight constriction. The posterior end is much broader than the anterior end. The cuticle covering the body surface is smooth and devoid of any armature.

A well developed oral sucker is present which is subterminal. It is rounded in shape having a diameter of 0.34—0.44 mm. The acetabulum, which is also rounded in shape is distinctly larger in size, measuring 0.40—0.55 mm. in diameter. It is placed at about one seventh of the body length from the anterior end and is found to overstep partly the intestinal caeca. The two suckers are placed close together, being separated by a distance of 0.10—0.26 mm.

The mouth leads into a very short oesophagus, which is completely covered over by the posterior margin of the oral sucker. At the point of bifurcation the caeca extend transversely and them turn backwards to run posteriorly toward the tail, where they end in blind tips. The walls of the caeca posterior to the acetabulum presen a corrugated appearance which is very prominent in this fluke. The caeca lie halfway betwee the median line and the external borders of the body. The excretory bladder has two distinc cornua and a short median stem opening terminally at the posterior end.

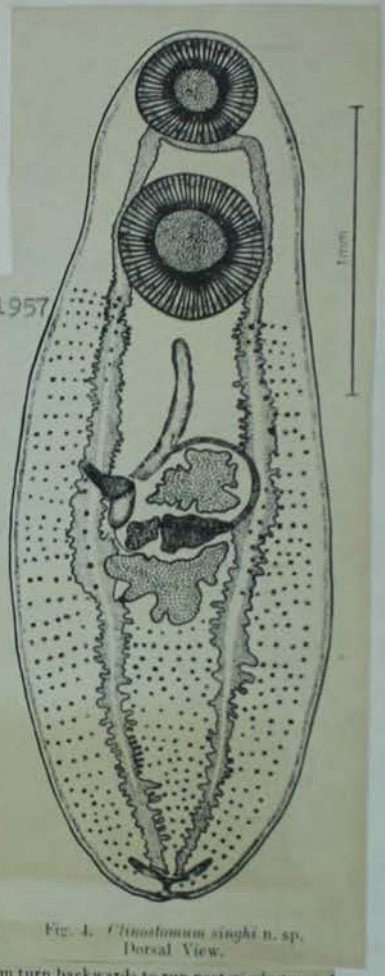


Fig. 4. *Clinostomum singhi* n. sp. Dorsal View.

The testes are arranged in tandem fashion and are placed in the anterior half of post-acetabular portion, with the hind border of posterior testis projecting slightly behind the equatorial level. They are lobulated and have indented margins. The two testes measure 0.28—0.32 by 0.18—0.22 mm. and 0.34—0.42 by 0.18—0.28 mm. respectively. The cirrus pouch is laterally situated on the left side of the anterior testis enclosing a protrusible cirrus.

The ovary is irregular in shape and is placed between the testes to the left of the median line, measuring 0.11 by 0.09 mm. The shell-gland occupies much bigger space than the ovary. The oviduct arises from the inner margin of the ovary and is continued beyond the ootype as the uterus. The utero-duct, which encircles the front testis, opens into a narrow and elongated uterine sac, the blind end of which approaches the acetabulum. At its posterior end the uterine sac communicates with a very short metraterm. The genital aperture lies lateral to the anterior testis at about its mid-level. The vitellaria consists of small rounded follicles extending laterally from the level of hind border of acetabulum to the hind end, completely covering the blind ends of the caeca. Anteriorly they extend only in the lateral zones of the body upto the caeca, whilst posterior to the hind testis they are distributed across the entire width of the body. The eggs are thin-shelled, measuring 115—123 μ long by 48—67 μ wide. They are few in number, having fully developed miracidia possessing eyespots.

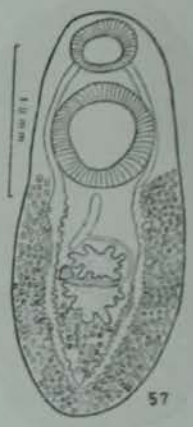
-OVER-

Clinostomum singhi Jaiswa', 1957

(Fig. 57)

The following study is based on three immature worms recovered from the buccal cavity of one specimen of *Ardeola grayi* collected at Peshawar.

The body of the fluke is oblong with broadly rounded ends and a constriction at the acetabular level. Maximum breath of the body is at the equator. The tegument is aspinose. The oral sucker is well developed, subterminal and almost spherical. The ventral sucker is larger than the oral sucker and lies at about one seventh of the body length from the anterior end. A very short oesophagus is present. The intestinal caeca after their separation from the intestinal fork diverge outwards for a short distance and then proceed backwards converging near the posterior end of the body and terminate a little in front of the posterior end. Behind the posterior level of the ventral sucker the caeca are corrugated throughout their extent.



57

The gonads are disposed in the middle third of post-acetabular region of the body. The testes are roughly tandem, intercaecal and highly lobed. The posterior testis is larger than the anterior. The oval cirrus pouch is postero-sinistral to the anterior testis. Enclosed within the cirrus pouch are a coiled vesicula seminalis, a ductus ejaculatorius, a pars prostatica and an armed cirrus. The genital atrium is at the mid level of the anterior testis. The ovary is irregular in shape, slightly indented, smaller than the testes, intertesticular and submedian, lying just behind the cirrus pouch. The Mehlis' gland is intertesticular. The uterine sac is narrow and elongated. Anteriorly it almost approaches the posterior margin of the ventral sucker. At its posterior end the uterine sac communicates with metraterm which opens into the common genital opening. The vitellaria are follicular and are distributed throughout the width of the post-acetabular space except for the area of the gonads and the uterine sac. The excretory vesicle is Y-shaped.

Measurements

(All measurements in millimetres))

Body length	2.727 – 3.636
Body breadth	1.151 – 1.363
Oral sucker	0.392 × 0.392 – 0.490
Ventral sucker	0.727 – 0.787 × 0.727 – 0.757
Anterior testis	0.196 × 0.294
Posterior testis	0.196 – 0.245 × 0.421 – 0.441

Host: *Ardeola grayi*
Location: Buccal cavity
Locality: Peshawar area

Discussion

The present material resembles *Clinostomum singhi* Jaiswal, 1957 in all essential features. There is no doubt that the specimens under study are the metacercarial stage of *Clinostomum singhi* Jaiswal, 1957. These are, however, being reported for the first time from Pakistan.

From BHUTTA AND KHAN, 1975

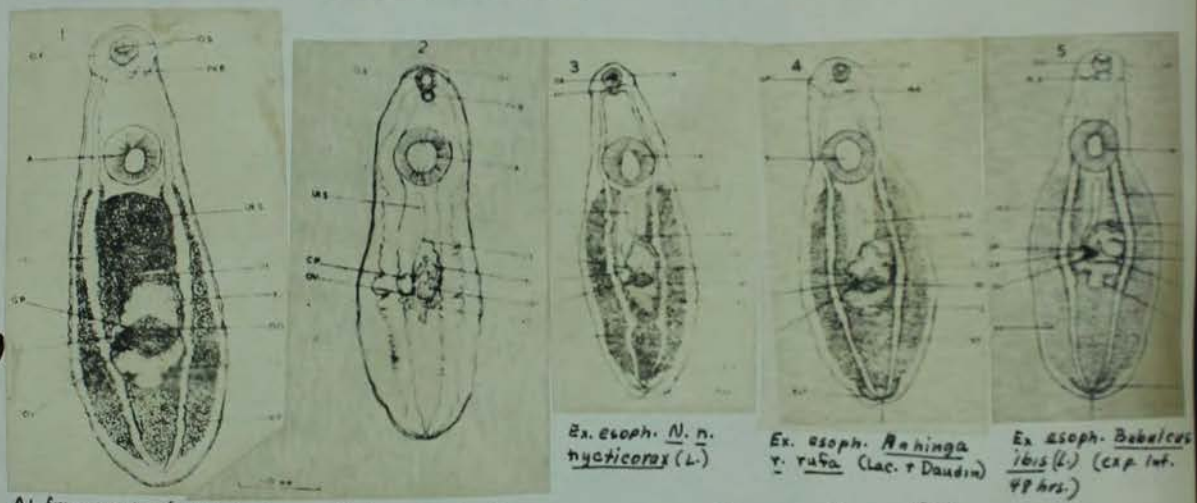
Clinostomum tilapiae Ukoli, 1966

Host: Cattle egret, Bubulcus ibis (L., 1758) (experimental host, esophagus and mouth cavity)

Intermediate host: Tilapia zilli, T. heudeloti, T. galilaea, freshwater fishes. Cysts in branchial region.

Locality: Nungua Lake near Accra, Ghana

Additional hosts (natural infections): Night heron, Nycticorax nycticorax nycticorax (L., 1758) from the dam at the University Botanical Gardens, Legon-Accra and African darter, Anhinga rufa rufa from Dawhenya Dam.



Ad. from esoph. of Bubulcus ibis (L.) (exp. host.)

Metacercaria from Tilapia zilli.

Ex. esoph. N. n. nycticorax (L.)

Ex. esoph. Anhinga r. rufa (Lac. + Daudin)

Ex. esoph. Bubulcus ibis (L.) (exp. inf. 48 hrs.)

ALL FROM UKOLI, 1966

See report for full description

5. - **Clinostomum tilapiae** UKOLI, 1966. Nrs. 23-275; 23-282. Adults.

Host: *Ardea goliath* CRETZSCHMAR; heron. - Location: Esophagus and crop. - Locality: Lac Kisale, Kikondja and Kadia, Congo. Collector: Prof. P. BRIEN. - Date: August, 1937.

UKOLI (1966b) reports this species from *Nycticorax nycticorax nycticorax* (LINN.), night heron; *Anhinga rufa rufa* (LACÉPÈDE & DAUDIN), African darter; and experimentally in *Bubulcus ibis* (LINN.), cattle egret; all ot Lac Nangue, Ghana. He found metacercariae encysted on the gills of three species of *Tilapia*.

From Manter & Pritchard 1969

Clinostomum tilapiae Ukoli, 1966
Metacercaria.

Hosts: *Tilapia heudeloti* Duméril, *T. zillii* (Gervais), *T. galilaea* Artedi (Cichlidae).

Habitats: Encysted in gill tissues and eye sockets.

Dates: 20 March 1959, 10 November 1965.

Specimens deposited: USNM Helm. Coll. No. 71632.

Discussion: Ukoli (1966a) described this species as metacercariae from the same host species and locality listed above, and as adults in naturally infected night herons, *Nycticorax n. nycticorax* (L.) (Ardeidae) and African darters, *Anhinga r. rufa* (Lacépède and Daudin) (Anhingidae) and experimentally infected cattle egrets, *Bubulcus ibis* (L.) (Ardeidae). Ukoli synonymized with *C. tilapiae* the adult *Clinostomum* sp. Dollfus, 1950 (fig. 57) from the heron *Ardea goliath* Cretzschmar (Ardeidae) from the Congo, and the metacercaria *Clinostomum* sp. Dollfus, 1950 (fig. 62) from *Tilapia melanopleura* Duméril from the Ivory Coast. Manter and Pritchard (1969) reported the adult in *Ardea goliath* from the Congo. Williams and Chaytor (1966) briefly described and illustrated the metacercaria of *Clinostomum* sp. from *Epiplatys senegalensis* (Steindachner) and *E. sexfasciatus* (Steindachner) (Cyprinodontidae) from Sierra Leone which we declare a synonym of *C. tilapiae;* they erroneously show the caeca opening into the excretory bladder and the distal part of the uterus and the cirrus sac as one structure.

From Fischthal and Thomas, 1970

Clinostomum vanderhorsti Ortlepp, 1935

"A new species of Clinostomum is described near to C. lophophallum Baer, 1933, but without a pharynx. The intestinal caeca open into the excretory canal. Heavy larval infestations occurred in the fish Gnathonemus macrolepidotus and adults were obtained by feeding these to Ardea melanocephala."------Helminthol. Abst.

Clinostomum sp. (Metacercaria)
(Figure 39)

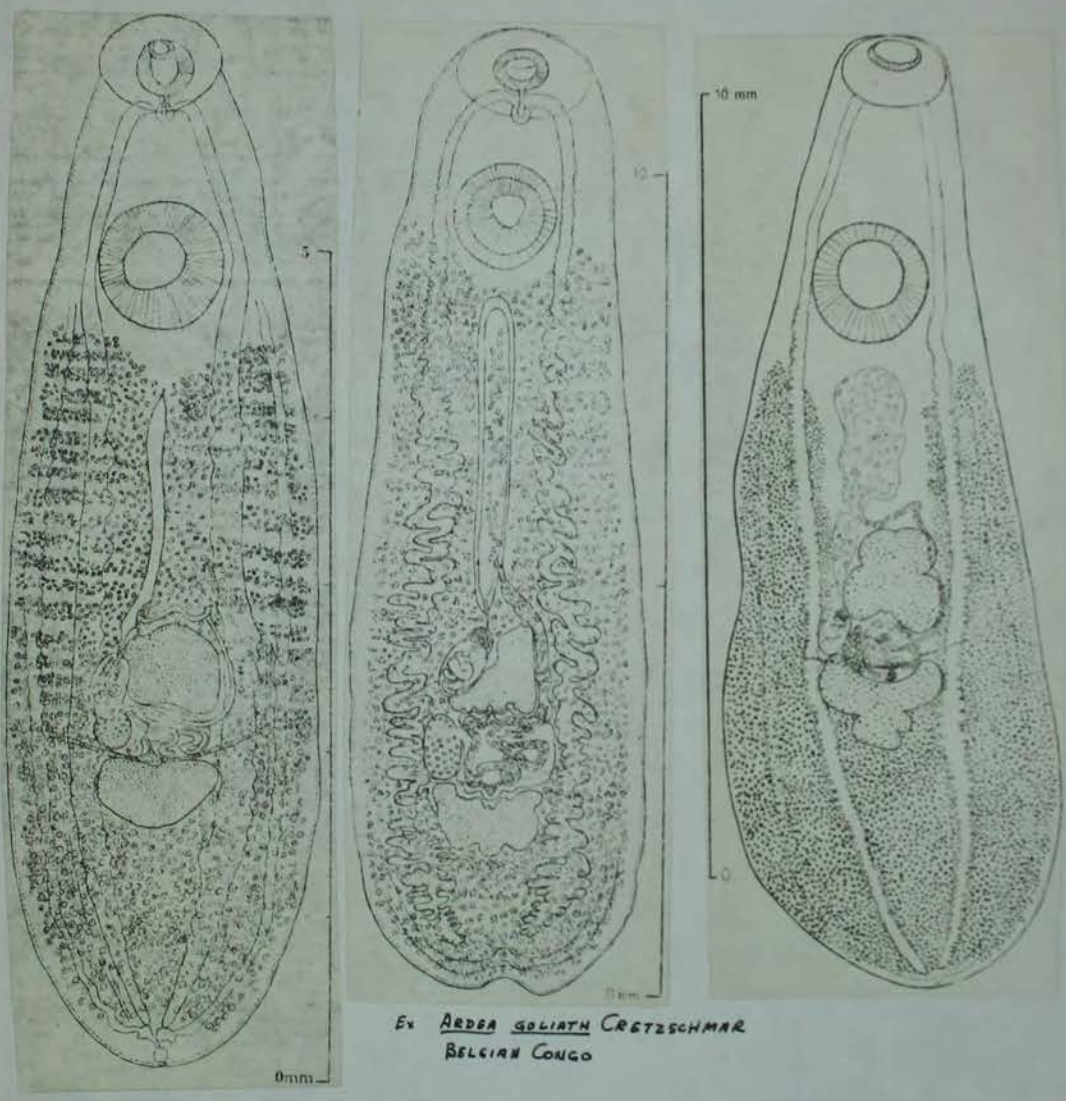
Host: *Tilapia zilli* (Gervais), *Tilapia nilotica* L., *Tilapia galilaea* (Artedi), *Tristramella simonis* (Gunter).
Habitat: skin; muscles (very rarely).
Locality: Lake Tiberias; Hule natural reserve. ISRAEL
Holotype: No. 717/Met. *Paratype*: No. 607/Met.

Description (based on the examination of 10 specimens). Body length 5.14–8.0 mm, width 1.82–2.8 mm. Oral sucker 0.5–0.6 mm, and pharynx 0.15–0.3 mm in diameter. Acetabulum 0.8–0.9 mm in diameter. Uterus Y-shaped, reaches the level of the acetabulum. The triangular testes with sinuous outline are situated in the middle of the body.

Discussion. The metacercariae resemble those of *C. complanatum* (Rud. 1819). However, the Y-shaped structure of the uterus and the anterior position of the genitalia are quite different from those of *C. complanatum* which has a tube-like non divided uterus, and whose genitalia are located posterior to the middle of the body. Our specimens are characterized also by the predominant place of encystation, the skin.

FROM PADERNA, 196

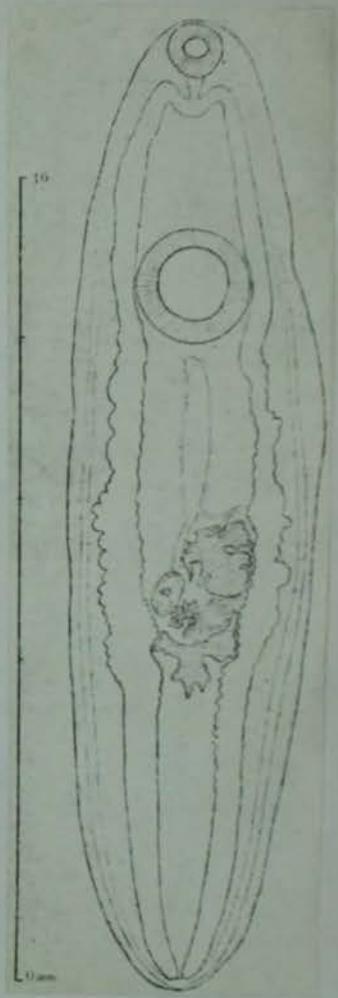
Clinostomum sp. from Dollfus, 1950



Ex ARDEA GOLIATH CRETZSCHMAR
BELGIAN CONGO

Clinostomatidae

Clinostomum sp. from Dollfus, 1950



Ex. Tilapia melanopleura
Dumeril, Ivory Coast
(from a cyst)

From: Manter & Pritchard, 1969

3. - **Clinostomum** sp. - Nr. 33-675. Metacercaria.

Host: *Auchenoglanis sp.*; (Bagridae). - Location: Encysted on intestine. - Locality: Makokou, Gabon. - Collector: F. PUYLAERT. - Date: August, 1967.

4. - **Clinostomum** sp. - Nrs. 33-719; 33-741; 33-742; 33-743. Metacercariae.

Hosts: *Chrysichthys walkeri* GÜNTHER; (Bagridae); *Chrysichthys nigrodigitatus* (LACÉPÈDE). - Location: Encysted in skin. - Localities: Lac Ezanga, Gabon. Nangue Ntongolo (Nengue Togolo), Gabon. - Collector: F. PUYLAERT. - Date: August, 1967.

Fam. Clinostomidae Lühe, 1901

9. *Clinostomum* sp. — metacercariae (Fig. 3f) MORAVEC & BARUS, 1970

Host: *Cichlasoma tetracantha* (Cuvier et Valenciennes).
Location: encysted in body cavity.
Locality: Rio Mosquito — old dam (province Pinar del Río).
Out of 31 hosts examined these metacercariae were found only in 1 of them (55 cysts).

Description: Cysts measuring 1.265—2.108 × 1.088—1.496 mm. Length of liberated metacercariae 2.625—3.142 mm, maximum width 0.816 to 0.898 mm. Oral sucker, surrounded by colar-like fold when retracted, measuring 0.190—0.218 × 0.163—0.177 mm, acetabulum 0.530—0.571 × 0.435 to 0.503 mm. Pharynx small, dia 0.068 mm. Caeca long, undilated, reaching to the end of body. Testes tandem (0.217—0.299 × 0.109—0.136 mm), at about middle of body. Small ovary (0.072—0.096 × 0.048—0.072 mm) situated submedially in space between testes. Immature uterus anterior to sexual glands.

The metacercariae found resemble those of the species *C. marginatum*, as described by Van Cleave and Mueller (1934). Since, however, more species of the genus *Clinostomum* occur in Cuba (see Yamaguti, 1958), we designate them only as *Clinostomum* sp.

Genre CLINOSTOMOIDES (2), n. gen. DOLLFUS, 1950

Définition du genre. — *Clinostomatinae* atteignant une grande taille; ventouse très rapprochées; intestin pourvu, en arrière de l'acetabulum, de sacculations nombreuses du côté externe, peu nombreuses du côté interne. Glandes génitales dans le dernier dixième de la longueur du corps; vitellogènes ne dépassant pas, antérieurement, le bord antérieur de l'acetabulum, mais en atteignant les côtés, très réduits au niveau de l'extrémité postérieure de l'intestin. Poche du cirre contre le bord interne de l'ovaire, dans l'espace intertesticulaire et s'avançant postérieurement et ventralement jusqu'au niveau du bord postérieur du testicule postérieur, de sorte que le pore génital est en arrière de l'espace intertesticulaire. Uterus avec saccules latérales (3). Extrémité antérieure de l'uterus ne pénétrant pas dans le tiers antérieur du corps, donc restant très éloigné de l'acétabulum; métraterme très large, submédian, croisant le milieu du testicule postérieur pour atteindre le pore génital.

(2) Etymol. : *Clinostomum* et suffixe *-oïdes*, ει, ε, ressemblant à. J'ai apocopé le radical *clinostomum*, ce qui aurait été assez disgracieux en grec pour les noms neutres en *um*, *ου*, *ου*, avec remplacement d'*o* par *ε*.

(3) Comme chez *Clinostomum detruncatum* M. Braun.

In view of the structure of these two larval forms, *Clinostomoides* ...cephali (Tabangui & Masilungan, 1944) and *Clinostomoides dolifusi* ..., the diagnosis of the genus has to be modified.

Clinostomoides (Dolifus, 1950) Diagnosis emended.

Small to very large forms. Intestine with diverticulae on both sides. ...ynx absent. Genital organs in the last eighth to tenth of the body. ...s transversely long. Cirrus sac extending upto the posterior border ...e posterior testis. Uterine sac prolonged behind the anterior testis with a long metraterm; with or without lateral sacculations and ...ps much removed from the ventral sucker than the latter from the ... sucker. Genital pore near the posterior testis and behind the ...testicular space. Vitelline-follicles not pre-acetabular.

FROM AGARWAL, 1959

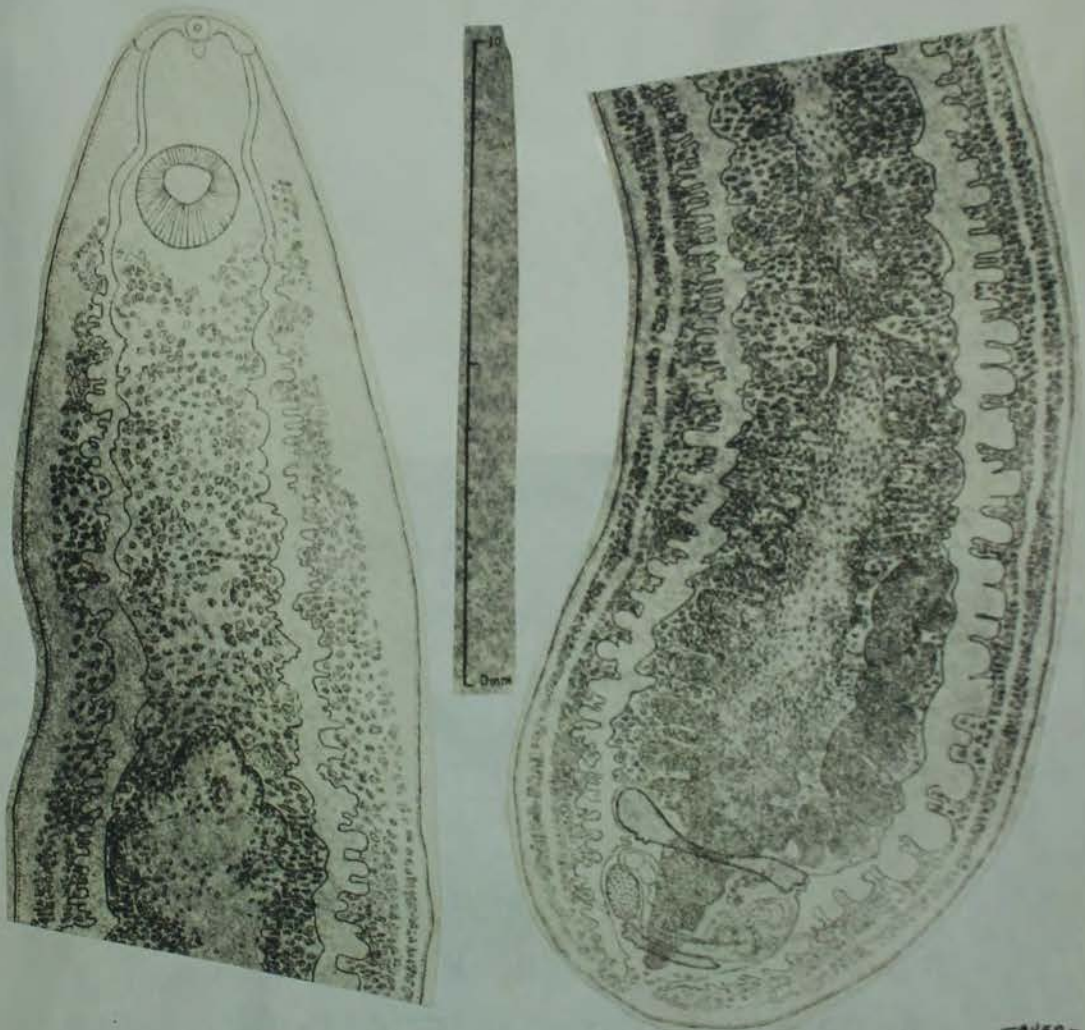
Clinostomoïdes Brieni n. gen., n. sp. DOLLFUS, 1950 Fig. 54.

MATÉRIEL EXAMINÉ: 1 spécimen de l'œsophage d'*Ardea goliath* CRETZSCHMAR, à Kadia (Congo belge); Paul BRIEN *leg.*, août 1937, n° 28277.

DIMENSIONS (en mm., sauf pour les œufs):

Longueur	30.7
Largeur au niveau de l'acetabulum	3.7
Largeur un peu en avant du testicule antérieur	7.5
Ventouse orale	0.4 environ
Ventouse ventrale	1.66
Ovaire	1.06 × 0.54

Oeufs 134 × 71 μ (133.9 × 70.9, 133.9 × 69, 133.9 × 74.8, 137.8 × 70.9 μ).



-OVER-

Description. — Corps presque 4 fois plus long que large; s'élargissant progressivement en direction postérieure jusqu'au niveau situé un peu en avant du testicule antérieur; extrémité postérieure régulièrement arrondie. Ventouse orale très petite. Ventouse ventrale beaucoup plus grande, ayant son centre vers la fin du premier dixième de la longueur du corps. Pharynx très petit. Branches intestinales dirigées d'abord en dehors, puis en direction postérieure jusqu'à l'extrémité, en laissant un certain espace entre eux et les bords latéraux du corps. En arrière du niveau du bord postérieur de l'acetabulum, les branches intestinales présentent de courtes sacculations irrégulières; ces poches latérales sont beaucoup plus nombreuses sur le bord externe que sur le bord interne. Testicules occupant en largeur l'espace intercaecal, au début du dernier dixième de la longueur du corps, très allongés transversalement, l'antérieur resserré vers le milieu de sa longueur; les bords sont, çà et là, légèrement lobulés. Il y a un assez grand espace entre les 2 testicules, il est occupé, de droite à gauche, par: l'ovaire, la poche du cirre, la terminaison de l'utérus, la glande de Mehlis. L'ovaire est régulièrement ovale, avec son grand axe un peu incliné par rapport à l'axe longitudinal du corps, il est contigu au caecum intestinal droit; contre son bord gauche se trouve la poche du cirre, un peu invurvée, s'étendant en direction postérieure jusqu'au bord postérieur du testicule postérieur.

La glande de Mehlis est très développée. L'uteroducte, à la sortie de la glande, prend une direction antérieure, croise le testicule antérieur et s'avance jusqu'à un peu pénétrer dans l'avant-dernier quart de la longueur du corps, puis se recourbe en direction postérieure, augmentant beaucoup de volume, et vient aboutir à l'utérus du côté gauche de celui-ci, un peu en avant du testicule antérieur. L'utérus est un sac à bords festonnés irrégulièrement, occupant la majorité de l'espace inter-caecal dans presque les deux derniers tiers du corps. Postérieurement il se rétrécit un peu pour traverser la partie médiane de l'espace intertesticulaire et il se termine un peu en arrière du bord postérieur du testicule postérieur, rejoignant l'extrémité postérieure de la poche du cirre, le pore génital étant submédian, au niveau du bord postérieur du testicule postérieur. Les vitellogènes occupent tout l'espace laissé libre entre les organes, depuis l'extrémité postérieure du corps jusqu'aux côtés de l'acetabulum; ils se trouvent en dehors et en dedans des caeca intestinaux comme des branches de la vessie excrétrice en U qui s'étend entre les caeca et les bords latéraux du corps. Le vitelloducte transverse passe entre l'ovaire et le testicule antérieur. Les œufs, extrêmement nombreux, contiennent à maturité un miracidium sans tache pigmentaire.

Remarques et discussion. — L'unique individu à ma disposition présente des caractères dont l'ensemble n'existe dans aucun des genres jusqu'à présent connus de *Clinostomatinae*; dans aucun de ces genres l'utérus n'a de terminaison postérieure semblablement disposée et le pore génital aussi postérieur et submédian; je me suis donc trouvé amené à proposer le genre nouveau défini plus haut. L'utérus sacciforme et la forme de la poche du cirre s'opposent à son admission dans les *Nephrocephalinae*.

Clinostomoides brieni Dollfus, 1950. From Prudhoa, 1957

(Fig. 6.)

Host and locality :

Clarias lazera. Mabwe, 585 m (1538, 1551, 1603).

Many immature examples of this trematode were found on three occasions encysted on the gills of *Clarias lazera* from a lake at Mabwe during August and September, 1947. A very similar form from *Clarias* sp. in Lake Nyasa is present in the collections of the British Museum (Natural History).

The body is somewhat boat-shaped in preserved specimens, being concave ventrally and convex dorsally, with margins somewhat inflexed ventrally. It measures 6 mm to 9 mm in length and 1,25 mm to 1,65 mm

in maximum width, which occurs usually in the anterior region of the body, although the width is nearly uniform throughout. The cuticle is provided with very minute spines densely arranged over the entire surface of the body.

The oral sucker is subterminal. It is more or less rounded and measures 0,25-0,35 mm in diameter, and its musculature does not appear to be very well developed. The ventral sucker, however, is very muscular and measures 0,60-0,65 mm in longitudinal diameter and 0,70-0,75 mm in transverse diameter. Though a true pharynx is apparently absent the hinder portion of the oesophagus seems to be invested with loose muscle-fibres and a vast number of gland-cells. This region of the alimentary system probably represents the degenerated pharynx described in *Clinostomum phalacrocoracis* by Dubois (1931). The intestinal caeca extend to near the posterior end of the body, and behind the ventral sucker they are provided with small marginal pockets. The excretory vesicle is more or less V-shaped, the limbs being lateral to the intestinal caeca and extending anteriorly to near the ventral sucker.

The testes are arranged tandem between the intestinal caeca in the posterior region of the body. They are transversely elongate and slightly arched, measuring about 0,15 × 0,06 mm, the hinder testis invariably being a little smaller than the foremost. In the median line or somewhat to the right, between the testes, an elongate cirrus-sac is situated. This measures between 0,30-0,50 mm in length and 0,12-0,15 mm in width. It contains a well-developed seminal vesicle and a long, muscular, ejaculatory duct, and opens into a genital atrium situated in the median line on the anterior border of the posterior testis. A pars prostatica does not appear to be differentiated, at least not in the juvenile stage.

The ovary is elongate, measuring about 0,25 mm in length and 0,05 mm in diameter. It lies between the testes, and between the cirrus-sac and the right intestinal caecum. The oviduct passes dorsally to the cirrus-sac to open into the « shell »-gland which lies to the left of the median line between the testes. From the « shell »-gland the uterine canal runs anteriorly, forming a number of loops to a point between 0,5 mm and 1 mm in front of the anterior testis, where it turns dorsally to run conversely to near the foremost testis, where it forms a right-angled bend to extend to the median line. In the median line, the uterine canal opens into the main uterine trunk, which extends anteriorly to about the middle of the body and posteriorly to the genital atrium.

The present form so closely resembles *Clinostomum brieni*, recorded by Dollfus (1950) from the oesophagus of *Ardea goliath* at Kadia, Belgian Congo, that the writer has no hesitation in regarding it as the metacercaria of this species.

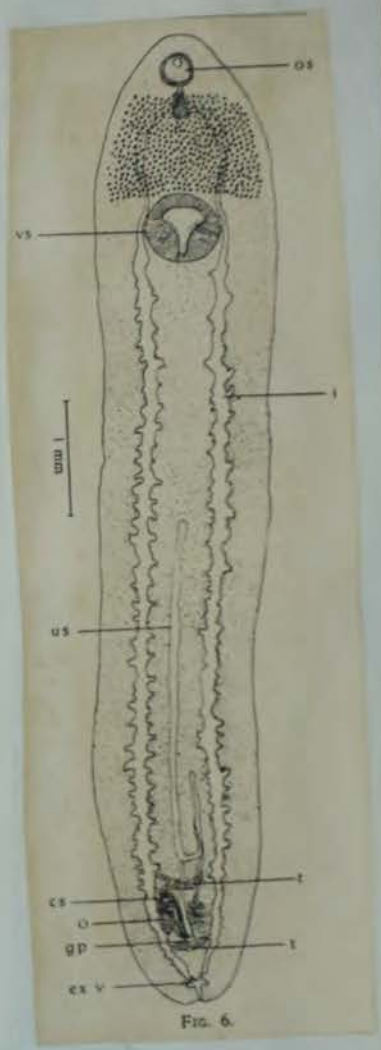
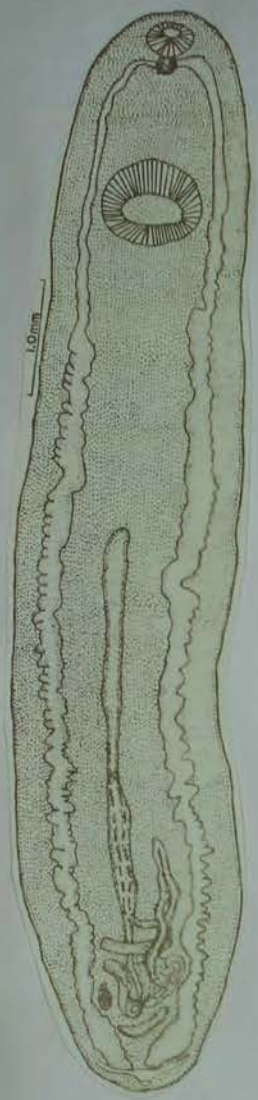


Fig. 6.



Clinostomoides brieni Dollfus, 1950
Metacercaria (Fig. 1)

Host: *Clarias senegalensis* Cuvier and Valenciennes (Clariidae).

Habitat: Encysted in pharyngeal region.

Date: 11 November 1964.

Specimens deposited: USNM Helm. Coll. No. 71633.

Description (based on three metacercariae): Body elongate, sides nearly parallel, extremities round, 5,980-9,085 long by 1,075-1,670 wide at acetabular level or just preacetabular. Forebody 935-1,280 long, hindbody 4,570-7,130 long; forebody-hindbody length ratio 1:4.41-5.57. Tegument spined from level of posterior part of oral sucker or prepharynx to posterior extremity, unspined anteriorly. Eye spots or scattered pigment granules on both sides of prepharynx or pharynx just anterior to caecal shoulders. Gland cells filling forebody. Oral sucker 175-195 by 295-340, lying 85-95 from anterior extremity; acetabulum transversally elongate, 475-675 by 590-895; sucker length ratio 1:2.29-3.39, width ratio 1:2.0-2.63. Prepharynx thick walled, muscular, 44-110 long; pharynx very muscular, with fibers radiating into surrounding parenchyma, margins indistinct, 140-200 by 110-195; prepharynx and pharynx surrounded by gland cells; no apparent esophagus; caecal bifurcation 407-735 preacetabular, lying dorsal to posterior part of pharynx, forming caecal shoulders before beginning descent, from acetabular level posteriorly caeca thick walled and with short diverticula on median and lateral sides, caeca terminating 135-185 from posterior extremity.

Testes two, tandem, intercaecal, much wider than long, in posterior one sixth to one eighth of body; anterior testis crescent shaped, ends round to very slightly lobed, 75-150 by 375-620, lying 3,565-5,790 postacetabular; posterior testis crescent to Y-shaped with arms widespread, 55-110 by 345-500, lying 280-445 posterior to anterior testis; posttesticular space 315-410 long. Cirrus sac thick walled, muscular, comma shaped, commencing anterior to ovary and ootype complex, 380-600 (longitudinal extent) by 105-260, containing bipartite, cell lined seminal vesicle, cell lined pars prostatica, prostate cells, and long, thick walled cirrus. Genital pore just submedian to right, immediately anterior to posterior testis.

Ovary small, very slightly lobed, dextral, intercaecal, longitudinally elongate, 200-287 by 92-144. Oviduct short, cell lined, surrounded by gland cells, passing sinistrally into ootype complex. Latter compact, 330-560 by 185-365, consisting of profuse Mehlis' gland whose outer margin is much lobed, and the much winding oviduct. Uteroduct thick walled, surrounded by gland cells, emerging midventrally from ootype complex, ascending sinistrally and intercaecally with some undulations to a point 1,920-4,970 postacetabular before looping posteriorly on itself, then proscribing a U-shaped, dextrally directed bend lying dorsal to proximal part of uteroduct, ascending dorsal to and opening into uterine sac posterior to latter's midlength. Uterine sac median, elongate, narrow, thick walled, surrounded by gland cells, 2,515-4,140 by 33-230, anteriormost tip lying 1,410-3,530 postacetabular, descending to genital pore ventral to cirrus sac.

Excretory bladder Y-shaped, entirely postcaecal, thick walled, cell lined; arms extending anteriorly on each side of body in extracaecal position, uniting at anterior margin of oral sucker; pore terminal.

Discussion: This species was described by Dollfus (1950) from a single adult from *Ardea goliath* from the Congo. Prudhoe (1957) described the metacercaria obtained from the gills of *Clarias lazera* Cuvier and Valenciennes from the Congo; he mentioned similar metacercariae in *Clarias* sp. from Lake Nyasa, Malawi. Manter and Pritchard (1969) briefly redescribed the metacercaria from *Clarias* sp. from Ruanda, declaring *Clinostomoides ophicephalus* (Tubangui and Masiluñgan, 1944) Agarwal, 1959, and *C. dollfusi* Agarwal, 1959, synonymous with this species. Our specimens differ from Prudhoe's account only in regard to the lack of spines on the anterior end of the body. It differs from both descriptions in regard to the presence of eye spots or its pigment, gland cells around the prepharynx and pharynx, and a Y-shaped posterior testis (in two worms); the submedian dextral position of the genital pore; the terminal part of the uteroduct ascending the uterine sac dorsally for a short distance before opening into it; and the union of the excretory arms at the anterior margin of the oral sucker.

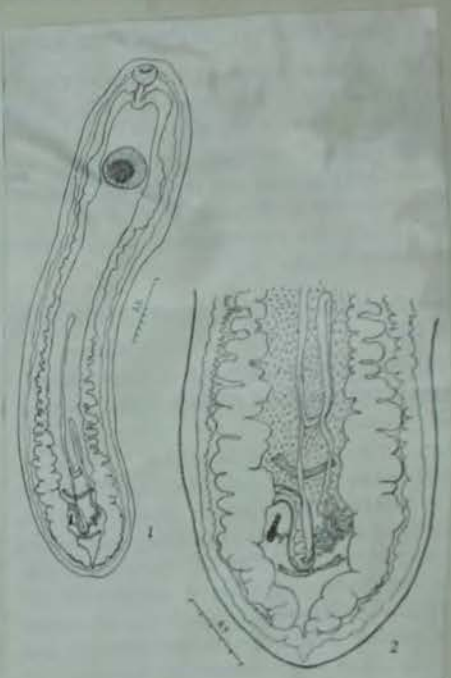
From Fischthal and Thomas, 1970

From Manter & Pritchard, 1969

6. - **Clinostomoides brieni** DOLLFUS, 1950. Nrs. 32-678; 32-679. Metacercariae. - (Figures 1-4).

Host: *Clarias sp.*; (Clariidae); 6 specimens (5, 1) from 2 hosts. - Location: Gills. - Locality: Lac Sake, Ruanda. - Collector: G. MARLIER. - Date: 29 March, 1960.

Brief description : Body 6.198 to 10.138 mm long by 1.443 to 1.850 mm wide; cuticular spines slender, sharply-pointed, 0.008 to 0.010 mm long, sparse or lacking around mouth; forebody 1/5 to 1/4 body length. Oral sucker 0.278 to 0.463 mm wide; acetabulum 0.574 to 0.833 mm wide; sucker ratio 1 : 1.9 to 2.2. Acetabulum with some radial muscles and dorsally-located bilateral complex of curved, more or less longitudinal, overlapping muscle bands; entire complex everting to form trilobed structure with one posterior and two anterolateral lobes (Fig. 3). Testes transversely elongated, in posterior 1/7 to 1/6 body length; anterior testis extending across intercaecal space, posterior testis sometimes less wide and mostly sinistral; cirrus sac intertesticular, dextral; genital pore median, immediately anterior to posterior testis. Ovary small, irregularly shaped, between cirrus sac and right caecum; uterus extending anteriorly on left side; uterine sac median, without lateral sacculations, in posterior half of body and well separated from acetabulum, receiving uterus near middle; vitellaria undeveloped; no eggs. Excretory pore dorsoterminal; vesicle small, V-shaped; large lateral vessels extending to region of oral sucker, complex system of tubules arising from lateral vessels.



Discussion: The acetabula of clinostomatids are generally described by such terms as strong, powerful, well-developed, and very muscular, but we cannot find that the distinctive arrangement of acetabular muscles described above for *C. brieni* has been reported previously. In personal correspondence, STEPHEN PRUDHOE (British Museum of Natural History) wrote: « The immature specimens of *Clinostomoides brieni* which I recorded from *Clarias lazera* in 1957 all have, to a more or less degree, the type of musculature of the ventral sucker that you have found. This is very noticeable in specimens showing the lumen of the sucker triangular in outline, and in these instances the trilobed organ is distinctly suggested ». He adds that indications of a trilobed organ are common features among clinostomatid metacercariae in African fishes, occuring in larvae of *Clinostomum* LEIDY, 1856, and *Euclinostomum* TRAVASSOS, 1928, as well as in *Clinostomoides* DOLLFUS, 1950.

We identified eleven metacercariae (Nrs. 32-674, 32-675, 32-676, and 32-677, see above Nr. 2) from *Tilapia nilotica* from Lac Mugesera, Ruanda, as *Clinostomum macrosomum* JAISWAL, 1957, and in seven of these there is evidence of a similar, though markedly reduced, trilobed organ. We also have from North American amphibians a series of metacercariae identified as *Clinostomum marginatum* (RUD., 1809) and *Clinostomum attenuatum* CORT, 1913; and two adult *Clinostomum intermedialis* LAMONT, 1920, from Venezuela. The latter were gifts from Dr. A. S. PEARSE and probably represent paratypes of the species. In these specimens the overlapping bands of muscles and elements of the trilobed organ are evident in the acetabulum. The larva of this species was reported by LAMONT (1920) from *Rhamdia quelen* QUOY and GAIMARD, a pimelodid freshwater fish closely related to the clariids. In the North American specimens, there is some slight indication of overlapping muscles in the acetabulum, but not of the trilobed organ.

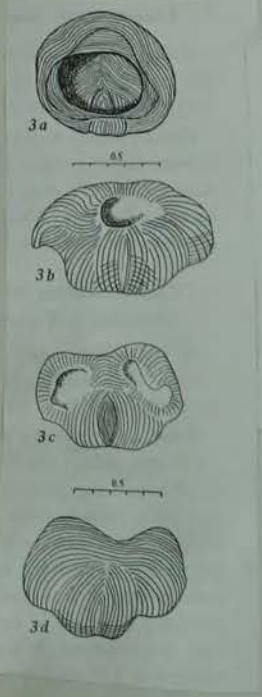
form reported originally from the gall bladder of *Ophiocephalus striatus* BLOCH, and later by VELASQUEZ (1960) from cysts on the gills of *Clarias batrachus* (L.) in the Philippines.

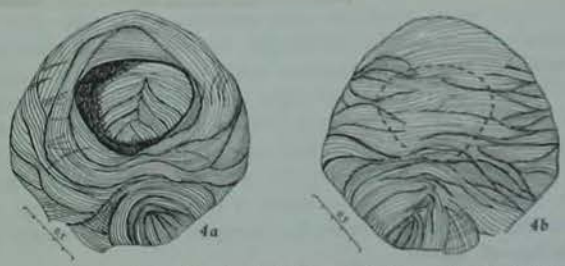
TUBANGUI and MASILUÑGAN (1944) noted that the gall bladder was an unusual site of infection for a clinostomatid, and VELASQUEZ (1960) did not find *C. ophicephali* in any of 300 *Ophiocephalus striatus* though she did report three specimens from two of 90 *Clarias batrachus*. AGARWAL (1959) transferred this species from *Clinostomum* to *Clinostomoides* and observed that the gonads were in the last eighth of body length, although the figure shows them in the posterior sixth. AGARWAL (1959) described *Clinostomoides dollfusi* as unspined with gonads in the posterior tenth of the body; but the gonads, according to the figure, are in the posterior seventh.

We are certain that our specimens are like those of PRUDHOE (1957) and we believe, further, that the above mentioned specimens from India and the Philippines are also the same species. Development from a cercaria to an adult some 30 mm long may involve changes in body proportions, and varying methods of fixation can cause other variations; body spines may be lost. All metacercariae were found in *Clarias* spp. The single specimen reported from the gall bladder of *Ophiocephalus* was in an abnormal site and, as later shown, probably in an abnormal host. Assuming that the uterine diverticula develop with maturity, we agree with PRUDHOE (1957) that the metacercariae he had were *Clinostomoides brieni*, and we further believe that all other metacercariae assigned to the genus are the same species. Thus *Clinostomoides brieni* DOLLFUS, 1950, is the only species of the genus, and its synonyms are *C. dollfusi* AGARWAL, 1959, new synonymy, and *C. ophicephali* (TUBANGUI and MASILUÑGAN, 1944) AGARWAL, 1959, new synonymy.

The holotype and only adult specimen of *Clinostomoides brieni* was kindly loaned by the Musée Royal de l'Afrique Centrale. In this specimen all elements of the trilobed organ observed in the metacercaria persist in the adult (Fig. 4). The marginal limits of the oral sucker are indistinct, but judging from the extent of the radial muscles, the sucker is 0,066 mm wide, which would result in a sucker ratio of about 1 : 2.5.

In addition to *C. brieni*, there are at present two species in the genus *Clinostomoides*: *C. dollfusi* AGARWAL, 1959, a metacercarial form from the branchial region beneath the operculum of *Clarias sp.* and *Saccobranchus sp.* (family Clariidae) in India; and *C. ophicephali* (TUBANGUI and MASILUÑGAN, 1944), AGARWAL, 1959, a metacercarial





Figs. 1-4. — *Clinostomoides brieni*. - 1. Metacercaria from gills of *Clarias* sp., ventral view; - 2. Metacercaria, detail of posterior part of body, including terminal genital ducts; - 3. Showing (a-d) successive stages of everted acetabulum in 4 different metacercariae; - 4. (a) ventral and (b) dorsal views of acetabulum of holotype (adult).

All figures drawn with the aid of a camera lucida with scales indicated in mms.

CLINOSTOMOIDES DOLLFUSI N. SP. AGARWAL, 1959

Body :—Medium sized, narrow with lateral margins parallel, white appearance, measuring 7.8-9.8 mm. long and 1.22-1.99 mm. broad. Cuticle nonspiny.

Suckers :—Oral sucker small, measuring 0.156-0.26 mm. long and 34-0.312 mm. broad. Ventral sucker 0.589-0.754 mm. long, 5-0.78 mm. broad and situated 0.949-1.144 mm. behind the oral ker. Pre-acetabular area is covered by numerous cell-bodies and k muscles.

Gut :—Mouth subterminal and encircled by the oral sucker. It ds into a long and narrow prepharynx. Dollfus, 1950 and other rkers on Clinostome forms have referred this structure as oesophagus my observations on the complete life-cycle of a Clinostome form, on a part of the life-cycle of *E. indicum* Bhalerao, 1942 and also morphology of some other clinostomes, has convinced me of the reasonableness of considering this structure as prepharynx rather than oesophagus. A discussion on this point will be included on a subsequent paper on *E. indicum* Bhalerao, 1942. Pharynx absent, oesophagus absent. Intestinal-caeca deeply diverticulated, both on the internal as well as external side and terminating blindly in front of the two arms of the excretory bladder.

Gonads occupy 0.74-0.79 mm. area, in the last tenth of the body of the worm.

Testes :—The anterior testis is transversely long, almost non-digitate except slight indication at the lateral margin, medially situated and measures 0.13-0.15 mm. long and 0.28-0·62 mm. broad.

Posterior testis is small, non-lobulate and measures 0.07-0.13 mm. long and 0.23-0.33 mm. broad. Cirrus-sac extends from a little beneath the anterior testis up to the level of the posterior testis, running parallel to the metraterm. It measures 0.39-0.62 mm. long and 0.1-0.18 mm. broad. Vesicula seminalis externa absent, vesicula seminalis interna small and pars-prostatica not visible.

Ovary :—Inter-testicular, ovoid in shape, non-lobulate, situated 0.31 mm. from the right margin and 0.86 mm. from the left margin of the body. It measures 0.15-0.22 mm. long and 0.07-0.13 mm. broad. From its inner margin arises an oviduct which meets the duct from the vitelline reservoir in the centre of the inter-testicular space and finally passes into the ootype. Receptaculum seminis is absent. The uterus, commencing from the ootype, coils a number of times in the space between the two testes on the right margin and then runs forwards to open in the uterine sac slightly above the anterior testis. The uterine sac is long, tubular without any lateral sacculations and its apex is about 3.05-3.57 mm. away from the ventral sucker (The distance between the tip of the uterine-sac and the ventral sucker is much larger than that between the two suckers). The uterine-sac thus extends upto the middle of the body anteriorly while posteriorly it is continued behind the anterior testis as a long metraterm opening to the outside through a genital pore which is situated behind the intertesticular space, just in front of the posterior testis or in level with it.

Vitellaria :—Not clear.

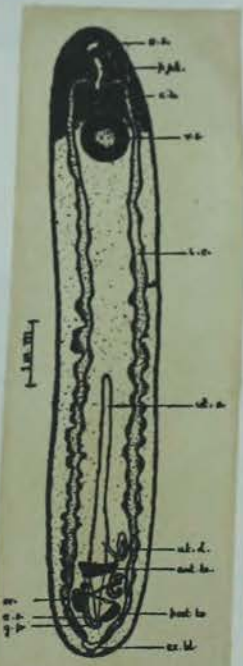
Excretory bladder is 'V' shaped.

Host :—*Clarias* sp. and *Saccobranchus* sp.

Location :— Branchial region beneath the operculum.

Locality :— Ranital and Gangasagar tanks in Jabalpur.

Habit :—Non-encysted, very active and move with lateral undulations of the body.



C. dollfusi n.sp.

o. s.—oral sucker; p. ph.—Prepharynx; c. b.—cell-bodies. l. c.—intestinal caeca; ut. s.—uterine-sac; ant. ts.—anterior testis; post. ts.—posterior testis; ov.—ovary; c. s.—cirrus-sac; g. p.—genital pore; ex. bl.—excretory bladder.

DISCUSSION

In his recent review, Dollfus (1950) has described the sub-family Clinostominae (Pratt, 1902) to include five genera, namely, *Clinostomum* (Rud., 1809), *Euclinostomum* (Rud., 1809), *Ithyclinostomum* (Diesing, 1850), *Clinostomatopsis* (Dollfus 1932) and *Clinostomoides* (Dollfus, 1950). The validity of the genus *Clinostomatopsis* (Dollfus, 1932) was doubted by Baer (1933) but Dollfus (1950) has upheld his earlier contention on account of certain characters of its forms, particularly the pre-acetabular extent of their vitelline follicles.

The genus *Clinostomoides* (Dollfus, 1950) of which only the adult type species *C. brieni* (Dollfus, 1950) has been described so far, has the following characters :

Body attaining very large size (30 mm., in the type-species), suckers very close together, intestinal caeca with many sacculations on the external and few on the internal side, gonads in the last tenth of the body, vitelline-follicles not pre-acetabular, cirrus-sac extending upto the level of the posterior border of the posterior testis so that the genital pore is behind the inter-testicular space, uterus very much removed from the ventral sucker, has lateral sacculations and a long metraterm.

The present form, *Clinostomoides dollfusi* n. sp., belongs to the genus *Clinostomoides* (Dollfus, 1950) on account of the nature of its intestinal caeca, position of its gonads in the last tenth of the body, uterine-sac very much removed from the ventral sucker, nature and disposition of its cirrus-sac and lastly in having the genital pore behind the inter-testicular space.

The present form, however, is interesting for the medium size of its body (7.8-9.8 mm. as against 30 mm. in the type species), absence of lateral sacculations from the uterus and in not having its suckers very close to each other.

The non-encysted nature of the metacercariae, absence of a pharynx, thick musculature and numerous cell-bodies filling the entire pre-abular space are points of further interest in the present forms. In of the above points a new species, *Clinostomoides dollfusi* is sted to include them.

The metacercaria, *Clinostomoides ophiocephali* (Tabangui & Masilun-1944) differs from the metacercaria *Clinostomoides dollfusi* n. sp., peculiar position in the gall bladder of the host, in the general of its cuticle, in the very small size of its body (2.8 mm.), position of its genital glands in the last eighth of the body and in certain other characters such as the comparative size of the al sucker with respect to the body and absence of any cell-bodies pre-acetabular zone.

CLINOSTOMOIDES
(~~Clinostomum~~) ophicephali (Tubangui & Masilungan, 1944) AGARWAL, 1959

Family CLINOSTOMIDÆ Luehe, 1901

CLINOSTOMUM OPHICEPHALI sp. nov. Plate 2, fig. 2.

This is represented by one specimen obtained from *Ophicephalus striatus*. It constitutes the third species of clinostomid metacercariae to be reported from this fish, the other two being *Clinostomum dalagi* Tubangui, 1933 and *Euclinostomum multicaecum* Tubangui and Masilungan, 1935.

Description.—Body slipper-shaped, 2.8 millimeters in length by 1.1 millimeters in maximum width across acetabulum. Cuticle armed with numerous minute spines. Oral sucker ventroterminal, 0.27 millimeter across; acetabulum at junction of anterior and middle thirds of body length, 0.40 by 0.54 millimeter. Pharynx apparently absent; oesophagus 0.1 millimeter long; intestinal caeca wavy in outline, with short lateral branches, reach to near posterior end of body.

Testes near posterior end of body, small, tandem, appear as mere transverse lines bent in the middle; anterior testis 0.22, posterior testis 0.20 millimeter across. Cirrus pouch well developed, between ovary and shell gland, 0.17 by 0.065 millimeter, its bulk on right side of median line; incloses small seminal vesicle and short cirrus. Common genital pore median, in front of second testis, about 0.2 millimeter from posterior end of body.

Ovary small, intertesticular, on right side of median line, 0.11 by 0.06 millimeter. Shell gland and ootype complex on left side of median line opposite ovary. Uterine sac median, longitudinal, 0.8 millimeter long, extends from genital pore to about half the distance between acetabulum and anterior testis.

Excretory pore slightly dorsal, near posterior end of body. Excretory bladder small, V-shaped; lateral excretory vessels very prominent, lateral to intestinal caeca.

Host.—*Ophicephalus striatus.*

Location.—Gall bladder. (This is an unusual location for this type of trematode. Clinostomid metacercariae are ordinarily encysted in the muscles and beneath the skin of their hosts.)

Locality.—Manila.

Type specimen.—Philippine Bureau of Science parasitological collection No. 669.

TEXT FIG. 2.

(1960) THREE
VELASQUEZ, FOUND C. OPHICEPHALI ENCYSTED ON GILLS OF 2 OF 90 CLARIAS BATRACHUS (L.); 300 O. STRIATUS BLOCH WERE NEGATIVE FOR C. OPHICEPHALI. STUDY OF PHILIPPINE EDIBLE FISHES.

15.24 to 29.21 Ovi. Invg. round worms

Tabangui and Masilungan (1944) described *Clinostomum ophiocephali* n the gall-bladder of *Ophicephalus striatus*. This form, in my opinion, ld be transferred to the genus *Clinostomoides* (Dollfus, 1950) on unt of its genital organs in the posterior end (last eighth) of the y, the position of the genital pore which is almost behind the inter-cular space, the long and median metraterm, the disposition of its e sac, the uterine sac very much removed from the ventral sucker, nature of intestinal caeca, absence of a pharynx and lastly in the e of its testes.

FROM AGARWAL, 1959

CLINOSTOMIDES

LOOSE LEAF
ORGANIZER

SCHEDULE

PERIOD OR TIME								
COURSE **MON.** INSTRUCTOR								
COURSE **TUE.** INSTRUCTOR								
COURSE **WED.** INSTRUCTOR								
COURSE **THU.** INSTRUCTOR								
COURSE **FRI.** INSTRUCTOR								
COURSE **SAT.** INSTRUCTOR								

NAME _____

ADDRESS _____

SCHOOL _____ TELEPHONE _____

Clinostomatopsis Dollfus, 1932

Generic diagnosis. — Clinostomidae, Clinostominae: Body stout, linguiform. Oral sucker without collar-like fold. Pharynx small, esophagus practically absent. Ceca simple, opening into excretory vesicle(?). Acetabulum large, about one third of body length from anterior extremity. Testes large, tandem, largely in posterior third of body. Genital pore behind anterior testis. Ovary submedian, intertesticular. Vitellaria surrounding whole length of ceca in hindbody, intruding into forebody. Uterus may not reach to acetabulum.

Genotype: *C. sorbens* (Braun, 1899) Dollfus, 1932 (Pl. 75, Fig. 911), in *Tantalus loculator;* Brazil. Also in *Ardea cocoi, Mycteria americana. Hoplerythrinus unitaeniatus, Hoplias malabaricus.*

Other species: *C. reticulata* (Looss, 1885), syn. *Clinostomum dictyotum* Montic., 1893, in "Wels"; Costa Rica. Also in *Axinurus dugesii.*

Mackal (1970) suggests this may not be a valid genus. See reprint and/or *Clinostomum almeidae* Mackal, 1970.

Clinostomum sorbens Braun, 1899.

Longueur: 9mm à 10mm; largeur maxima: 2mm,9.

La ventouse orale a 0mm,35 à 0m,47 de diamètre. Il semble y avoir un pharynx rudimentaire. La ventouse ventrale a 2mm à 2mm,5 de diamètre. Les glandes génitales se trouvent dans le tiers postérieur du Ver. Le pore sexuel se trouve entre les deux testicules à droite de la ligne médiane. L'utérus n'atteint pas le bord postérieur de la ventouse ventrale. Les glandes vitellogènes forment deux bandes latérales se réunissant en avant de l'utérus, et s'étendant au delà de la ventouse ventrale de chaque côté de celle-ci. Les œufs ont 104 μ à 114 μ de long et 73 μ à 83 μ de diamètre. Adulte chez *Ardea cocoi* L., *Mycteria americana* L. et *Tantalus loculator* L. Développement inconnu.

Braun (1901, p. 35) considère *C. sorbens* si différente des autres espèces du genre qu'il faudrait presque créer un nouveau genre pour l'y loger. Dollfus (1932) a établi le genre *Clinostomatopsis* pour cette espèce, sans toutefois donner une diagnose de son nouveau genre. *C. sorbens* diffère des autres espèces essentiellement par le fait que les glandes vitellogènes dépassent le bord antérieur de la ventouse ventrale. Ce caractère à lui seul ne justifie pas selon nous la création d'un nouveau genre.

From Baer, 1933

CLINOSTOMATOPSIS

Euclinostominae n. subfam.

Subfamily diagnosis. — Clinostomidae: Body stout, linguiform. Oral sucker surrounded by collar-like fold of body wall. Pharynx rudimentary. Ceca with numerous long lateral branches in hindbody. Acetabulum strongly developed, about one third of body length from anterior extremity. Testes tandem, near posterior extremity. Cirrus pouch and genital pore in front of anterior testis. Vitellaria surrounding cecal branches in hindbody. Uterus reaching to acetabulum.

Euclinostomum Travassos, 1928

Generic diagnosis. — Clinostomidae, Euclinostominae: Body stout,

linguiform. Oral sucker surrounded by collar-like fold of body wall. Pharynx rudimentary. Ceca with numerous long lateral branches in hindbody. Acetabulum strongly developed, near anterior extremity. Similar to *Clinostomum* in other internal anatomy. Parasitic as larva in fish, as adult in Ardeiformes.

Genotype: *E. heterostomum* (Rud., 1809) (Pl. 77, Fig. 936), in *Ardea purpurea;* Europe. Also in *Ardeola ralloides, Nycticorax nycticorax, Garzetta garzetta, Ardea goliath,* etc.

Larva in fish — Mönnig (1926). Metacercaria encysts in liver, rarely in wall of body cavity or kidney of *Ophiocephalus punctatus;* adults in buccal cavity of *Nycticorax nycticorax nycticorax* (natural and experimental infection) — Srivastava (1950).

Other species:

E. africanum (Stoss., 1906) Dollfus, 1932, in "Nyosi" (silure); French Congo.

E. clarias (Dubois, 1929), larva in body cavity of *Clarias angolense;* Africa.

E. multicaecum Tubangui et Masilungan, 1935, (larval form) encysted in muscles of *Ophiocephalus striatus;* Philippines.

UKOLI (1966) RECOGNIZES ONLY 2 SPECIES:
E. HETEROSTOMUM SEE REPRINT.
E. MULTICAECUM

Review of the Genus *Euclinostomum* Travassos, 1928

Travassos (1928) created the genus *Euclinostomum* with *E. heterostomum* as type species; a generic diagnosis was not given. Yamaguti (1958) created the subfamily Euclinostominae with *Euclinostomum* as its only genus; four species were listed, namely, *E. heterostomum* (type), *E. africanum*, *E. clarias*, and *E. multicaecum*.

Euclinostomum heterostomum was first described as *Distoma heterostomum* from adults from the purple heron, *Ardea purpurea*, by Rudolphi (1809). The description was rather general and brief, dealing with external features, and was without an illustration. No mention was made of a pharynx or whether the uterodurct opened at the anterior tip or middle of the side of the uterine sac. Braun (1899) and Looss (1899) placed this species in the genus *Clinostomum* Leidy, 1856. Braun (1900) listed chronologically a series of references to this form, but none added any significant data to Rudolphi's original description. In this same paper Braun presented the first thorough account of the morphology of adult *E. heterostomum* obtained from herons, *Ardea purpurea*, *A. cinerea*, and *Nycticorax griseus*, from southern Europe. He stated that a pharynx-like structure was present at the cecal bifurcation preceded by a prepharynx (esophagus according to Braun), and that the uteroduct opened at the anterior tip of the uterine sac. It is apparent that Braun's study, being the first complete description of adult *E. heterostomum*, must be the basis for any subsequent comparisons of this form with others of the genus.

Monnig (1926) reported from the muscles of an unnamed fish from South Africa three metacercariae of *E. heterostomum*, without describing them. From egrets, *Garzetta garzetta*, in Indochina, Joyeux and Houdemer (1928) recorded adult *E. heterostomum* under the generic name *Ithyoclinostomum* Witenberg, 1925, stating that their specimens agreed with the description by Braun (1900). Metacercariae were found by them in the muscles of the fish, *Ophicephalus scandens*. Travassos (1928) and Dollfus (1932) indicated that Joyeux and Houdemer were in error in placing this species in *Ithyoclinostomum*. Dollfus (1932) recorded a single adult *E. heterostomum* from the heron, *Ardeola ralloides*, near the River Niger, West Africa. Srivastava (1950) found metacercariae of *E. heterostomum* in the fish, *Channa* (*Ophiocephalus*) *punctatus*, from India; they were embedded in the liver and attached to the kidneys or muscles of the coelomic wall. Adult worms occurred naturally in the night heron, *Nycticorax nycticorax nycticorax*, and experimentally in the latter as well as the cattle egret, *Bubulcus ibis coromandus*. Miracidia were hatched from eggs. An exceedingly brief description of the morphology of the metacercaria was given, but nothing of the adult or miracidium; no illustrations were given. Shigin (1954) reported adult *E. heterostomum* from *Ardea cinerea* from Russia.

On the basis of three specimens (one immature) from the heron, *Ardea goliath*, from the Belgian Congo, Dollfus (1950) described briefly, but illustrated well, what he called *E. heterostomum*. The mature specimen 16.2 mm long in his figure 52 shows a distinct pharynx followed by a definite esophagus; additionally, the uteroduct opened into the side of the uterine sac just anterior to its middle. These characteristics are unlike those in *E. heterostomum* as described by Braun (1900). It is our opinion that the mature specimens of Dollfus (1950) represent a new species for which we propose the name **Euclinostomum dollfusi**, n. sp. The immature specimen 22.5 mm long in Dollfus' figure 53 is without a prepharynx, and shows a distinct pharynx followed by a definite, though short, esophagus; additionally, the uteroduct opens at the anterior tip of the uterine sac, unlike the mature specimen figured.

In Celebes van der Kuyp (1953) described adult worms from dark grey herons, and metacercariae from the muscles of the fish, *Ophicephalus striatus*, calling each a stage of *E. heterostomum*. No experimental feeding of metacercariae to herons was made to determine whether the former developed into adults in the latter. Van der Kuyp stated that the identification of the adult worm was confirmed by Dr. R. P. Dollfus. In our opinion the adult *E. heterostomum* of van der Kuyp is the same species as the mature *E. heterostomum* of Dollfus (1950) which we have designated above as *E. dollfusi*, n. sp. It is also our opinion that van der Kuyp's metacercaria represents a species different from his adults, and that this larval stage is similar to the immature worm of Dollfus (1950); we believe they represent a new species, and for them is proposed the name **Euclinostomum vanderkuypi**, n. sp. In the opinion of Agarwal (1959) the three specimens described as *E. heterostomum* by Dollfus (1950) "should be given a new specific status on account of its differences in the size of the body, the point of opening of the uterodust in the uterine sac, the position of the gonads and also the comparative sizes of the testes"; however, he failed to designate a new specific name.

Euclinostomum indicum was described by Bhalerao (1942) from metacercariae

– OVER –

from the body cavity of the fish, *Channa (Ophiocephalus) punctatus*, from India. They possessed a prepharynx, pharynx, and an esophagus visible only in sections; additionally, the uteroduct opened at the anterior tip of the uterine sac. Agarwal (1959), also in India, collected from herons, *Bubulcus ibis*, fed with the fish *Channa (Ophiocephalus) punctatus*, 12 specimens identified as immature to mature stages of *E. indicum*. Comparisons of Bhalerao's metacercaria and Agarwal's adults of *E. indicum* with descriptions of the same stages of *E. heterostomum* presented by us in this paper and by Braun (1900) make it apparent that *E. indicum* is a synonym of *E. heterostomum*. Agarwal stated that the former differed from the latter particularly in the presence of a well-developed, thickly muscular pharynx (located at the caecal bifurcation) rather than lacking one, and in the presence of a distinct, well-developed vitelline reservoir rather than lacking one. The description and in particular the illustration of *E. heterostomum* by Braun (1900) indicates the presence of a pharynx (at the caecal bifurcation) exactly like that of *E. indicum*. "Vom Oesophagus habe ich immer nur die wie ein Pharynx erscheinende Einmundung an der Gabelstelle des Darmes gesehen". Braun also noted the presence of a vitelline reservoir. "Zwischen beiden Hoden liegt . . . in der Mitte des Vorderrandes des hintern Hodens das Dotterreservoir". In summarizing Braun's data Dawes (1946) was in error in indicating that a pharynx was absent and the cuticle spined. Baer (1933) also was in error in reporting a vitelline reservoir lacking.

Agarwal (1959) claimed to have both metacercariae and adults of *E. heterostomum* in his collection, but did not list the hosts from which they were obtained. He stated that they were apharyngeal and the long tubular prepharynx entered the intestinal bifurcation directly. The only known apharyngeal *Euclinostomum* also occur in India, and have been described by Jaiswal (1957) as *E. bhagavantami* and *E. heptacaecum*. Perhaps Agarwal's *E. heterostomum* is one of these. Agarwal (1959a) described the egg and miracidium of what he (1959) called *E. heterostomum*. Eggs were obtained from adult worms in herons (unnamed) fed encysted metacercariae found in the fish, *Channa (Ophiocephalus) punctatus*. He (1960) mentioned feeding metacercariae of his *E. heterostomum* to herons, *Bubulcus ibis*.

Euclinostomum africanum (Stossich) Dollfus, 1932, was poorly described as *Clinostomum africanum* after the death of Stossich by Galli-Valerio (1906) from notes left by the former. The parasite was a young form recovered from the intestine of a fish known as "nyosi" from French Congo. Dollfus (1950) thought that perhaps this form belonged to the genus *Clinostomoides* Dollfus, 1950. Van der Kuyp (1953) declared it a synonym of *E. heterostomum*. Dollfus (1932), Baer (1933), van der Kuyp (1953), Agarwal (1959a), and Velasquez (1960) considered it a *species inquirienda*. We concur.

Euclinostomum clarias (Dubois, 1930) Dollfus, 1932, was described by Dubois (1930) as *Clinostomum clarias* from metacercariae from the body cavity of the fish, *Clarias angolense*, from Africa. The uteroduct opened at the anterior tip of the uterine sac. Dubois (1931) noted a typical trematode pharynx for this parasite, unlike the atypical structure in *E. heterostomum*, *E. dollfusi*, and *E. vanderkuypi*. Dollfus (1932, 1950) questioned the validity of this species. Van der Kuyp (1953) declared it a synonym of *E. heterostomum*. We consider this species valid in having a typical pharynx, the gonads located in the posterior fourth of the body, and the uterine sac commencing far posterior to the acetabulum.

Euclinostomum multicaecum was described by Tubangui and Masilungan (1936) from metacercariae encysted in the muscles of the fish, *Channa (Ophiocephalus) striatus*, from the Philippines. Velasquez (1960) redescribed it from unencysted metacercariae found lying beneath the visceral peritoneum. Almost all caecal diverticula reached the posterior end of the body. The pharynx was rudimentary, and the uteroduct opened at the anterior tip of the uterine sac. Van der Kuyp (1953) created the genus *Tumaclinostomum* for this species, basing it solely on the posterior extent of the diverticula. We declare *Tumaclinostomum* a synonym of *Euclinostomum* inasmuch as this characteristic only represents a degree of development, belonging on the species level; in all species of *Euclinostomum* the diverticula extend posteriorly to some extent. In our opinion *E. multicaecum* is a valid species.

Euclinostomum bhagavantami was described by Jaiswal (1957) from a single adult worm from the reef heron, *Demiegretta asha*, from India. This species may be distinguished from the others, including *E. dollfusi* which it resembles in having the uteroduct opening at the middle of the side of the uterine sac, in being apharyngeal.

Euclinostomum heptacaecum was described by Jaiswal (1957) from a single metacercaria from the body cavity of the fish, *Channa (Ophiocephalus) punctatus*, from India. Jaiswal used extremely variable characteristics in separating this form from others, namely, width of uterine sac, number of caecal diverticula, and lack of branching diverticula. Several characteristics of this parasite appear to be of far greater validity for separation, namely, S-shaped cirrus pouch, no metraterm, opening of uterine sac directly to the exterior through a uterine pore, and, with the exception of *E. bhagavantami*, lack of a pharynx. *E. heptacaecum* differs from the latter in having its uteroduct opening at the anterior tip of the uterine sac.

Euclinostomum channai was described by Jaiswal (1957) from a single metacercaria from the intestine of the fish, *Channa (Ophiocephalus) marulius*, from India. Again, he used extremely variable characteristics for separation of this species from others, namely, unbranched and distended diverticula with rounded terminations, and a slight body constriction in the acetabular region. More valid characteristics exist for separating this form from others, with the exception of *E. heptacaecum*, and these are the same as listed for the latter species. Jaiswal did not attempt to distinguish *E. channai* from *E. heptacaecum*. In our opinion the former is a synonym of the latter.

KEY TO THE KNOWN ADULTS OF *Euclinostomum*

1.	Uteroduct opening at anterior tip of uterine sac	2
1.	Uteroduct opening at middle of side of uterine sac	3
2	Esophagus apparent, short	*E. vanderkuypi*, n. sp.
2	No apparent esophagus	*E. heterostomum* (Rudolphi, 1809)
3	Pharynx present, rudimentary	*E. dollfusi*, n. sp.
3	Pharynx absent	*E. bhagavantami* Jaiswal, 1957

KEY TO THE KNOWN METACERCARIAE OF *Euclinostomum*

1	Pharynx absent	*E. heptacaecum* Jaiswal, 1957
1	Pharynx present	2
2	Almost all caecal diverticula extending to posterior end of body	*E. multicaecum* Tubangui and Masilungan, 1936
2	A few posterior caecal diverticula only extending to posterior end of body	3
3	Anterior tip of uterine sac far posterior to acetabulum, lying posterior to middle of postacetabular body length	*E. clarias* (Dubois, 1930)
3	Anterior tip of uterine sac relatively close to acetabulum, lying well anterior to middle of postacetabular body length	4
4	Esophagus apparent, short	*E. vanderkuypi*, n. sp.
4	No apparent esophagus	*E. heterostomum* (Rudolphi, 1809)

FROM FISCHTHAL AND KUNTZ, 1963

Euclinostomum TRAVASSOS 1928

The genus *Euclinostomum* was established by TRAVASSOS in 1928 for Clinostomes having well developed caecal diverticula. In 1929 DUBOIS recorded an immature form, *Euclinostomum clarias*, from the body cavity of a Siluroid fish, *Clarias anguillaris* and again in 1932 he described the adult form *E. heterostoma* (Syn. *Clinostomum heterostomum* RUDOLPHI 1809) from the pharynx of *Ardeola ralloides* from Niger Valley. BAER (1933) reviewed the family Clinostomidae and gave a key for the identification of *Euclinostomum* species, designating *Euclinostomum heterostomum* (RUDOLPHI 1809) as the type of the genus. TUBANGUI (1935) made the species *E. multicaecum* for metacercaria found encysted in the muscular tissue of *Ophicephalus striatus* in Philippines. BHALERAO (1942) created *E. indicum* for metacercaria found parasitic in the body cavity of *Ophicephalus punctatus* in Poona.

Key to the metacercarial forms of Euclinostomum.

Uterine sac extends into the vicinity of the acetabulum . . . . 1.
Uterine sac does not extend into the vicinity of the acetabulum . . 3.

1. Anterior region sharply marked off from the rest of the body by a neck like construction in the acetabular portion . . . . . *E. clariasi* n. sp.
Anterior region not sharply marked off from the rest of the body . . . 2.

2. Uterine sac narrow . . . . . *E. indicum* BHALERAO 1942.
Uterine sac broad and extremely truncated anteriorly . . . *E. multicaecum* n. sp.

3. Gonads in the middle thirds of the body . . . *E. multicaecum* TUBANGUI 1935.
Gonads in the posterior third of the body . . . *E. clarias* DUBOIS 1929.

FROM: JAISWAL, 1957

Clé des genres.

1	Intestin avec de longs diverticules latéraux, parfois ramifiés	EUCLINOSTOMUM
	Intestin avec de courts diverticules latéraux jamais ramifiés	2
2	Vers atteignant plusieurs centimètres; glandes vitellogènes n'atteignant pas la moitié antérieure du corps	ITHYCLINOSTOMUM
	Vers n'atteignant pas plusieurs centimètres; glandes vitellogènes dépassant la moitié antérieure du corps. .	CLINOSTOMUM

EUCLINOSTOMUM Travassos, 1928. Syn. *Clinostomum* Leidy, 1856 *pro parte.*

Clinostominés dont les diverticules latéraux de l'intestin sont très longs et ramifiés et ne se trouvent que sur les faces latérales du tube digestif. Il semble y avoir un pharynx rudimentaire L'utéroducte débouche dans l'utérus près de la ventouse ventrale. Adulte dans la bouche et dans l'œsophage d'Ardéiformes. Métacercaire dans la cavité générale de Poissons.

Espèce type: *Euclinostomum heterostomum* (Rudolphi, 1809).

Euclinostomum heterostomum (Rudolphi, 1809).

Longueur: 6mm,7 à 9mm; largeur maxima: 3mm,5.

La ventouse orale mesure 0mm,31 à 0mm,36 sur 0mm,27 à 0mm,33. La ventouse ventrale a 1mm,4 de diamètre. Le pharynx paraît rudimentaire. Les organes génitaux se trouvent dans la moitié postérieure du Ver. Le testicule antérieur présente une dépression sur son bord antérieur là où se trouve la poche du cirre et l'atrium génital. L'ovaire se trouve à droite de la ligne médiane. Il n'y a pas de réservoir vitellin. L'utéroducte, très long, remonte sur le côté gauche du Ver jusqu'au bord postérieur de la ventouse ventrale où il débouche dans l'utérus. Les glandes vitellogènes s'étendent d'en arrière du testicule postérieur jusqu'au bord postérieur de la ventouse ventrale. Les œufs ont 125 à 135 μ de long et 62 à 73 μ de diamètre. Adulte chez *Phoyx purpurea* (L.), *Ardeola ralloides* Scop. *Nycticorax nycticorax* L., *Ardea cinerea* L. et *Garzetta garzetta* (L.).

La seule forme larvaire correspondant au genre *Euclinostomum* est *E. clarias* (Dubois, 1929) trouvée dans la cavité générale d'un Silure, *Clarias angolense* Steindach. Cette métacercaire se distingue de *E. heterostomum* par le fait que les organes génitaux se trouvent dans le dernier tiers du Ver et que l'utérus ne s'étend que jusqu'au milieu du corps et non jusqu'à la ventouse ventrale, comme c'est le cas de l'espèce type.

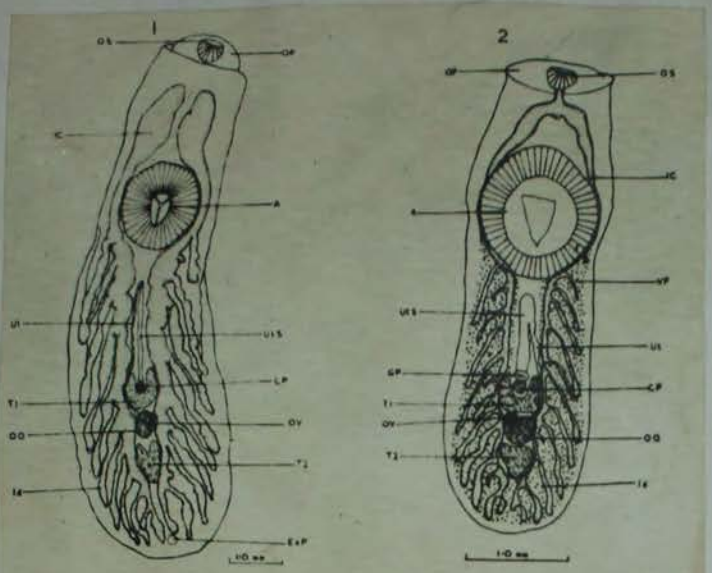
From Baer, 1933

Euclinostomum
~~Clinostomum~~ heterostomum (Rudolphi, 1809) Braun, 1899

Travassos ? Baer, 1933

FROM: BRAUN, 1900
HOST: ARDEA PURPUREA

-OVER-



Euclinostomum heterostomum (Rud., 1809)

Fig. 1.—Metacercaria from the body wall of *Tilapia zilli*; whole mount; dorsal view. Fig. 2.—Adult from the oesophagus of *Anhinga rufa rufa*, 3 days 18 hours after experimental infection with metacercaria; whole mount; ventral view.

A—Ventral sucker, **CP**—Cirrus pouch, **ExP**—Excretory pore, **GP**—Genital pore, **IC**—Intestinal caecum, **Id**—Intestinal diverticulum, **OF**—Oral field, **OO**—Ootype complex, **OS**—Oral sucker, **OV**—Ovary, **T1**—Anterior testis, **T2**—Posterior testis, **Ut**—Uterus, **UtS**—Uterine sac, **VF**—Viteline follicles.

FROM UKOLI (1966) ALSO A REDESCRIPTION (SEE REPRINT).

1. - **Euclinostomum sp.** - Nr. 33-605. Metacercariae.

Host: *Pelmatochromis kingsleyae* (BOULENGER); (Cichlidae). - Location: Intestine. - Locality: Nangue Ntongolo (Nengue Togolo), Gabon. - Collector: D. THYS VAN DEN AUDENAERDE. - Date: 13 November, 1964.

These specimens are probably *Euclinostomum heterostomum* (RUD., 1809) TRAVASSOS, 1928. UKOLI (1966a) reports this species from Ghana where metacercariae occur encysted in the body wall of two species of *Tilapia* ANDREW SMITH, 1840. Experimental final hosts were the darter, *Anhinga rufa rufa* (LACÉPÈDE & DAUDIN), and the shag, *Phalacrocorax africanus africanus* (GMELIN). UKOLI recognized only two species of *Euclinostomum*, *E. heterostomum* and *E. multicaecum* TUBANGUI & MASILUÑGAN, 1935.

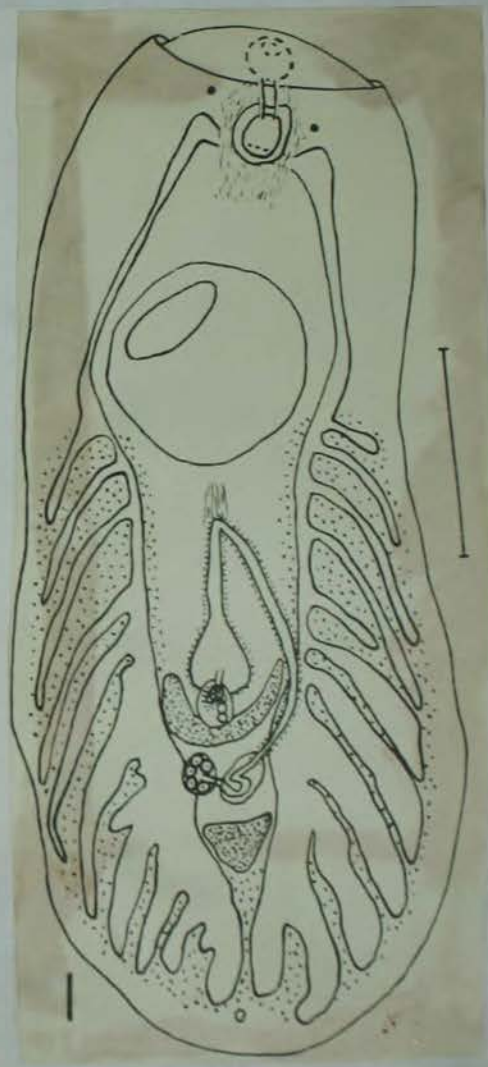
From: Manter + Pritchard, 1969

METACERCARIA OF *Euclinostomum heterostomum* (RUDOLPHI, 1809)

DIAGNOSIS (based on 39 specimens, eight measured): Euclinostominae. Body elongate, broad, rounded at both ends, occasional specimen with distinct lateral constrictions in acetabular region making postacetabular body region appear rounded; length 4.494 (3.340–5.650), width at anterior testis 1.912 (1.549–2.416); collar-like formation at anterior end, length 0.264 (0.154–0.353); postacetabular body length 2.569 (1.880–3.534); cuticle unspined; oral sucker small, weak, ventral, dorsal or terminal depending on state of contraction at time of fixation, anterior to cephalic collar, 0.229 (0.207–0.238) x 0.267 (0.238–0.307); acetabulum large, strong, at approximately one-third length of body from anterior end, 0.877 (0.675–1.035) x 0.889 (0.759–1.074); ratio of lengths of suckers 1: 3.05–4.35; cercarial eyespots present at level of anterior part of pharynx, anterior to caecal shoulders; prepharynx short, thick-walled, muscular, length 0.161 (0.10–0.207), opening into antero-ventral part of pharynx; pharynx rudimentary, being a dilated muscular chamber at caecal bifurcation, thick-walled and of two distinct layers, inner layer thin and compactly muscular while outer layer thicker and less compactly muscular, 0.301 (0.255–0.335) x 0.301 (0.275–0.315), surrounded by loosely arranged parenchymal muscles extending from level of posterior margin of oral sucker up to approximately half way between caecal bifurcation and acetabulum; no apparent esophagus, caecal bifurcation dorsal to posterior part of pharynx, caeca ascending sides of pharynx before looping caudad, terminating at posterior end of body; lateral caecal diverticula commencing at level of posterior part of acetabulum, extending postero-laterally with some reaching almost to body margins and some continuing short distance farther posteriorly parallel to margins, branching varying from none in some specimens to some branching in others, caeca and diverticula may be distended or narrow or only some distended or only sections of diverticula distended (end, middle, or beginning), ends may be pointed or rounded in single individual; number of diverticula varying from eight to 13 as follows in seven specimens (right-left caecum): nine-nine, nine-ten, ten-ten, 11-ten, 11-ten, 13-eight, 13-12; excretory pore subterminal, dorsal, distance of pore from posterior end of body 0.160 (0.061–0.253); bladder very short, dividing into two lateral branches ramifying profusely throughout body.

Testes two, in tandem, intercaecal but may be in contact with caeca, in posterior half of postacetabular body region and in about posterior one-third of total body length, ends rounded; anterior testis broadly U- to crescent-shaped, thickness (at bend of U) 0.124 (0.092–0.168), total width 0.496 (0.390–0.621), distance from acetabulum to anterior testis 0.924 (0.614–1.220); posterior testis Y-shaped to triangular (with apex pointing posteriorly), 0.304 (0.228–0.414) x 0.345 (0.299–0.422), distance from acetabulum to posterior testis 1.570 (1.077–1.918); *vas efferens* of posterior testis long, originating from right anterior corner of latter, extending anteriorly along right side of intercaecal space, passing ventral to ovary and anterior testis to meet *vas efferens* of anterior testis; latter very short, originating in bend of U to left of *vas efferens* from posterior testis; *vasa efferentia* joining to form very short *vas deferens* entering cirrus sac; cirrus sac within arms of anterior testis, overlapping ventrally bend of latter and usually uterine sac, 0.176 (0.136–0.224) x 0.152 (0.118–0.199), slightly oval, thick-walled, containing seminal vesicle, prostate gland cells, and cirrus; distance from acetabulum to cirrus sac 1.018 (0.706–1.319); internal seminal vesicle bipartite, thick-walled; cirrus short, thick-walled, opening into genital atrium; prostate gland cells surrounding anterior end of anterior chamber of seminal vesicle and cirrus; genital atrium median, short; genital pore at level of anterior third of cirrus sac.

–OVER–



Metacercaria of Euclinostomum heterostomum (Rudolphi, 1809)

Ovary small, round, smooth, 0.153 (0.110-0.180) x 0.161 (0.127-0.184), intertesticular, on right side of intercaecal space, occasionally overlapping right caecum ventrally, not in contact with either testis, distance from acetabulum to ovary 1.302 (0.874-1.628); oviduct short, relatively thin-walled, arising from mid-dorsal surface of ovary, extending left toward mid-line of body and entering dorsodextral part of ootype complex; ootype complex distinctly differentiated from surrounding parenchyma, to left of ovary, large, compact, oval, diagonally oriented from postero-dextral to antero-sinistral in intercaecal space, occasionally contacting left caecum, long axis 0.303 (0.235-0.372), short axis 0.183 (0.129-0.221); oviduct much coiled within ootype complex and surrounded by profuse Mehlis' gland, uteroduct thick-walled, surrounded by gland cells throughout length, emerging from ventral side of ootype complex near its antero-sinistral end, arcs antero-sinistrally overlapping left caecum ventrally, opening at anterior end of uterine sac in mid-line of body; uterine sac thick-walled, median, also surrounded by gland cells throughout length, extending posteriorly to within arms of anterior testis, usually overlapping cirrus sac dorsally, uterine sac width variable from specimen to specimen, being narrow to partly inflated to entirely inflated, length 0.758 (0.445-0.920), distance from acetabulum to anterior end of uterine sac 0.221 (0.107-0.314); metraterm thin-walled, short, narrow, leaving ventral surface of uterine sac subterminally, opening into genital atrium; vitellaria present or absent, when present follicles immature and partially or completely distributed, when completely present follicles extending posteriorly in lateral fields from level of posterior part of acetabulum, overlapping caeca and diverticula, becoming confluent posttesticular, and reaching to posterior end of body, when first forming follicles present only in antero-lateral fields near acetabulum; paired vitelline ducts from each lateral vitelline field uniting to form right and left vitelline ducts ventral to ootype complex, latter ducts uniting to form short common vitelline duct passing dorsally to ootype complex, vitelline reservoir not developed at this stage.

HOSTS: *Tilapia* sp. and *Tilapia zillii* (Cichlidae), and *Clarias* sp. (Claridae).

HABITATS: Body cavity, mesenteries, liver, kidney, and small intestine.

LOCALITIES: Canal at Abu Rauwash and Giza Fish Market, Giza Province, and canal at El Marg, northeast of Cairo, Egypt.

DATES: July 28 and September, 1948 (*Tilapia* sp.); August 1 and 16, September 6, and October 12, 1952 (*Tilapia zillii*); and August 23, 1953 (*Clarias* sp.).

SPECIMENS DEPOSITED: U. S. Nat. Mus. Helm. Coll., No. 59715 (3 whole mounts from *Tilapia* sp.), No. 59716 (2 whole mounts from *Tilapia zillii*), and No. 59717 (2 whole mounts from *Clarias* sp.).

Both smaller and larger specimens were in the collection, but were unsatisfactory for obtaining complete measurements. The presence of cercarial eyespots is the first report of this structure in a *Euclinostomum* metacercaria. No doubt they have been overlooked by other investigators.

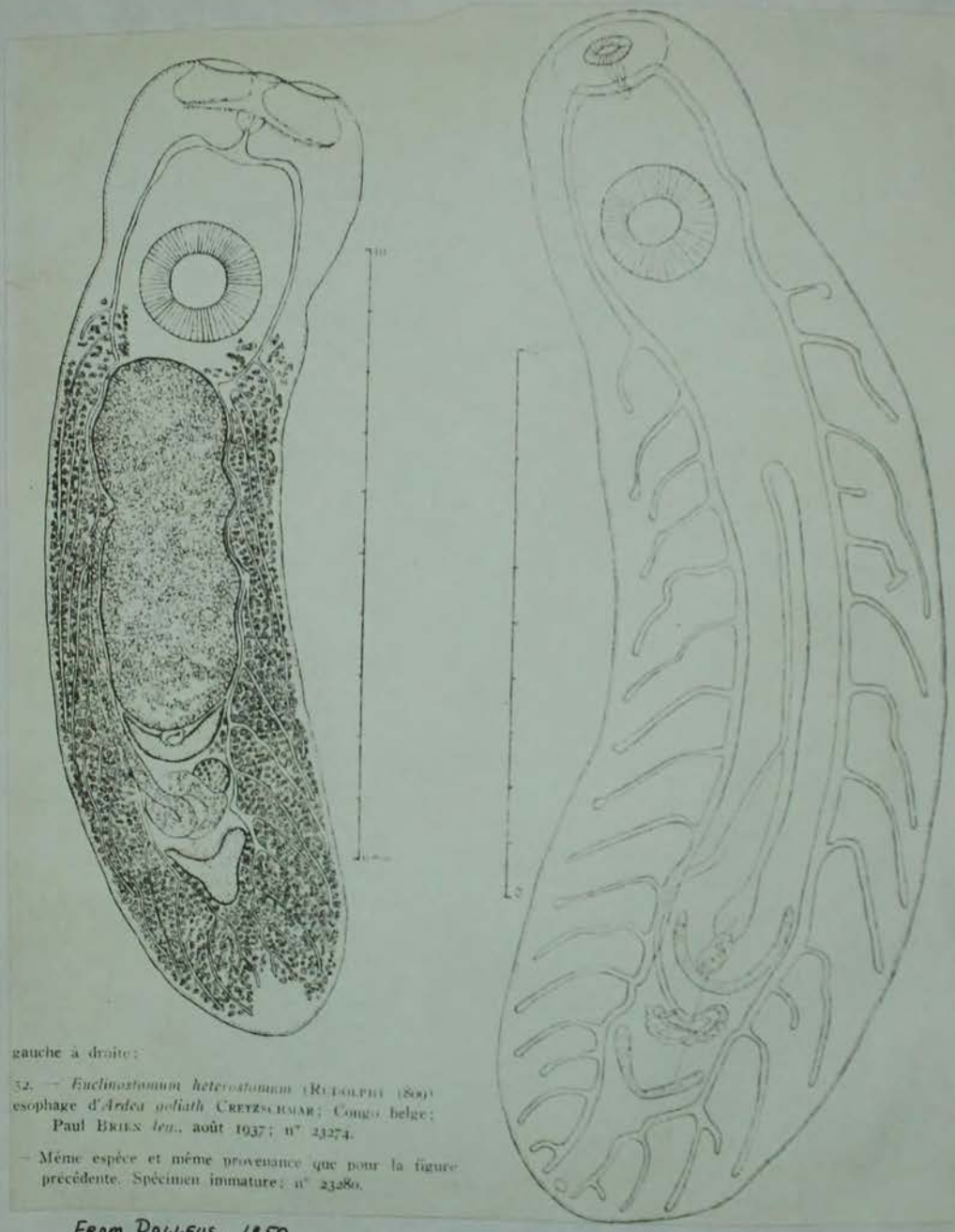
FROM FISCHTHAL AND KUNTZ, 1963

Euclinostomum heterostomum
(Rudolphi, 1809) Travassos, 1928
Metacercaria

Hosts: *Tilapia zilli* (Gervais), *T. heudeloti* Dumeril (Cichlidae).
Habitat: Encysted in kidneys.
Date: 13 September 1959.

Discussion: Ukoli (1966b) reported this metacercaria from the same host species and locality listed above. Adults were obtained by him from experimentally infected *Anhinga r. rufa* and long-tailed shags, *Phalocrocorax a. africanus* (Gmelin) (Phalocrocoracidae). He also reviewed the genus *Euclinostomum* Travassos, 1928, but made no reference to the earlier review by Fischthal and Kuntz (1936). The latter authors noted that specimens they recognized as *E. heterostomum*, either as metacercariae or adults, had been reported from South Africa, Mali, Egypt, southern Europe, Russia, Indochina, and India. Manter and Pritchard (1969) reported the metacercaria of *Euclinostomum* sp. from *Pelmatochromis kingsleyae* (Boulenger) (Cichlidae) from Gabon, stating that it probably is *E. heterostomum*. FROM FISCHTHAL AND THOMAS, 1970

Euclinostomum heterostomum (Rud., 1809)



gauche à droite :

52. — *Euclinostomum heterostomum* (RUDOLPHI 1809) œsophage d'*Ardea goliath* CRETZSCHMAR ; Congo belge ; Paul BRIEN *leg.*, août 1937 ; n° 23274.

— Même espèce et même provenance que pour la figure précédente. Spécimen immature ; n° 23280.

FROM DOLLFUS, 1950

Clinostomidae

Euclinostomum heterostomum (Rudolphi 1809)

1. *Euclinostomum heterostomum* (Rudolphi, 1809) was recovered from arround the glottis of the pond heron, *Ardeola bacchus* (Bonaparte), which is a new host of this trematode. This is the first record of this genus from China.

FROM CHIN Tahsiung and Yiming, 1976

Euclinostomum heterostomum (Rudolphi, 1809)

(Figure 6 a–b)

Adult.

A single mature specimen was recovered from beneath the tongue of a grey heron (*Ardea cinerea*) obtained at the Fisheries Research Station in the Lowveldt Reserve. In the collections of the British Museum (Natural History) there are several specimens of this trematode from the oesophagus of the hammerhead (*Scopus umbretta*) from Lydenburg, Transvaal, and from Salisbury, Rhodesia, a host not hitherto recorded for *E. heterostomum*.

The body of a fully-mature adult of this species is elongate, rounded posteriorly, and somewhat flattened at the anterior extremity, which bears a plain cephalic depression forming a collar 0,8–1,4 mm in diameter. There is often a shallow constriction around the body at the level of the ventral sucker, and forward from this point the body may taper slightly. It varies from 6,7 to 10,5 mm in length and from 2,9 to 3,5 mm in maximum width, at the level of the anterior testis in the hinder fourth of the body. The cuticle is smooth.

The oral sucker lies in a mound arising from the floor of the cephalic depression. It often appears to be weakly developed and measures 0,31–0,36 mm in length and 0,27–0,40 mm in width. The ventral sucker is a well-developed muscular organ situated at about the anterior fourth of the body-length. It varies between 1,3 and 1,6 mm in diameter and gives an oral/ventral sucker ratio of 1:2,5–3,5. The aperture of the sucker is rounded or triangular in outline, but may often be reduced to a T-shaped opening, which may suggest a trilobed organization of the muscles of the wall of the sucker.

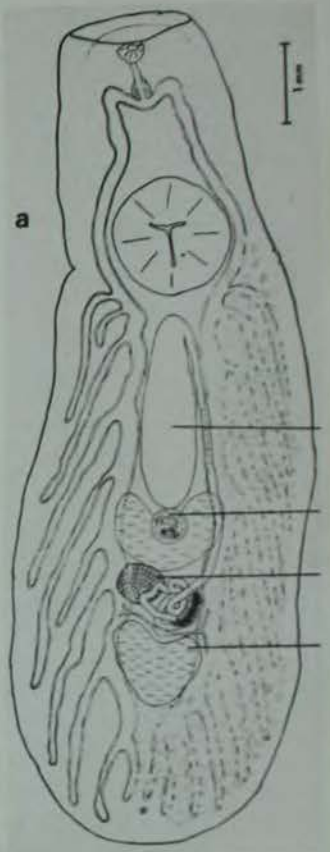
Apparently there is no pharynx, despite the assertion of Dennis & Sharp (1973), and the oral sucker leads directly into an oesophagus, the hinder region of which is provided with a relatively thick musculature forming a bulbous structure. A thick mass of gland-cells invests this bulb, and the ducts from these cells pass through the walls of the bulb and open into its lumen. Immediately following this muscular bulb, the oesophagus bifurcates and opens directly into a pair of intestinal caeca that reflex to run antero-laterally for a short distance before turning abruptly to proceed almost to the posterior end of the body. Behind the level of the ventral sucker the intestine repeatedly gives off 10 to 13 finger-like appendages, which are directed postero-laterally and lie roughly parallel to each other in a diagonal plane. These appendages may also branch occasionally, and the hinder end of each intestinal caecum appears to bifurcate.

The excretory pore is situated in a dorsal and median position near the posterior end of the body. In specimens of this trematode examined by the writers, the excretory vesicle appears to have a very thin wall and is not sufficiently differentiated from the surrounding tissue for details of its shape to be made out in whole mounts.

The genital pore is represented by a slit in the body-wall and is situated in the median line at about the junction of the middle and hinder thirds of the body-length. It leads into a shallow atrium, at the base of which lie the openings of the cirrus-sac and metraterm. The cirrus-sac is rounded, pyriform or oval, and well developed. It is relatively large, with its greater diameter in a dorso-ventral plane, and lies in the median line ventrally to the foremost, somewhat U- or V-shaped, testis or in the crotch of this testis. The cirrus-sac contains a bipartite seminal vesicle.

The two testes lie close together, one directly behind the other, between the intestinal caeca and between 1,8 and 3,4 mm from the hinder end of the body. The posterior testis is reniform, with lobes directed forward, and measures up to 1,15 mm in transverse diameter and up to 0,8 mm in length. The anterior testis is of similar size and also reniform, but the lobes are so extended as to be almost U- or V-shaped in outline.

The ovary is situated to the right of the median line between the testes and may partially overlap the intestinal caecum on that side. It is a compact, rounded organ with a diameter of up to 0,50 mm. A "shell"-gland complex is not sufficiently differentiated for its structure to be interpreted with any degree of accuracy in whole mounts. The vitellaria consist of a large number of closely-packed follicles, 50 to 60 μm in diameter. They are disposed laterally from about the hinder level of the ventral sucker to the posterior end of the body, overlying the intestinal caeca and their branches dorsally and ventrally. In addition, the vitelline follicles are confluent in the median line behind the posterior testis, but leave the area around the excretory pore clear. Further, in contracted specimens, the vitellaria may also be confluent in the median line immediately behind the ventral sucker. Ducts from the follicles lead into a pair of longitudinal canals, one anterior and the other posterior, lying ventral to each in-



testinal caecum. These canals unite to form on each side a transverse duct, which crosses the body to unite with its fellow immediately in front of the hinder testis. At their junction in the median line, the transverse canals swell to form a distinct yolk-reservoir.

The uterus arises from the oviduct and is thrown into a few short coils within the space bounded by the testes and the intestinal caeca. From this region it extends round the left-hand margin of the anterior testis, along the ventral side of the left-hand caecum and then towards the median line to just below the level of the ventral sucker. Here it enters a uterine sac subterminally. The sac is dilated and elongate, tapering anteriorly, and has relatively thick walls. It lies between the intestinal caeca and extends from behind the ventral sucker to the cirrus-sac. The metraterm is not clearly visible, but appears to leave the hinder region of the sac subterminally, on the left-hand side. The uterus, and much of the uterine sac, is filled with large, oval eggs, which are slightly flattened at the opercular pole. They measure from 127 × 74 μm to 135 × 77 μm.

Metacercaria (Figure 6b)

Two metacercariae of this species were found in the tissues of *Sarotherodon* (*Tilapia*) *mossambicus*, also from the Lowveldt Reserve. In many respects the present immature forms resemble the adult, notably in the number and form of intestinal diverticula and in the point of entry of the uterus into the uterine sac. Both specimens are somewhat contracted, each having an almost oval outline, with a shallow constriction at the level of the ventral sucker, making the outline of the body reminiscent of a key-hole. The length of the body in the two specimens is 5,8 and 7,12 mm, and the maximum width, at the level of the anterior testis, 2,84 and 3,30 mm, respectively. The cephalic depression is 0,13–0,18 mm in transverse diameter. Cercarial eye-spots, mentioned by Fischthal & Kuntz (1963), are not apparent. The oral sucker has a diameter of 0,21–0,26 mm and is funnel-shaped or bulbous. One of the specimens has a triangular aperture to the ventral sucker, but this condition is not indicated in the other specimen. The diameter of the ventral sucker is 1,25–1,30 mm. The oral/ventral sucker ratio is 1:5–6. The morphology of the digestive system of the metacercaria is very similar to that of the adult. It may be noted, however, that in both metacercariae the gut is filled with food so that the intestinal limbs are somewhat expanded.

The excretory pore lies 0,34 mm from the hinder end of the body in both specimens. In one metacercaria there is a sausage-shaped bladder (0,24 × 0,13 mm) extending anteriorly from the excretory pore. In both specimens the genital atrium is situated in the median line, anterior to the cirrus-sac. The atrium is surrounded by muscles and gland-cells. The cirrus-sac is well developed and measures about 125 μm × 170–220 μm. It lies at the base of the crotch of the anterior U-shaped testis.

In the metacercaria, as in the adult worm, the testes are disposed in tandem, but are more slender than in the adult so that the anterior testis is definitely U-shaped, whilst the posterior one has the form of a 'Y' with a very short stem or the outline of an inverted triangle. Their dimensions are 0,42–0,43 mm in length and 0,48–0,55 mm in overall width for the anterior testis, and 0,33–0,54 mm in length and 0,46–0,6 mm in width for the posterior testis. Respectively, the testes are situated 1,28 and 1,94 mm from the hinder end of the body in the smaller specimen, and 1,73 and 2,92 mm in the larger.

The ovary, which lies at about midway between the testes, is oval and measures 0,12–0,13 mm by 0,25–0,26 mm. There is an expansion of the oviduct to the left of the ovary which is a partly-formed seminal receptacle. Vitelline follicles are distributed as in the adult, although they are much smaller. A well-developed uterus and uterine sac are also present. The latter is elongate-oval with a transverse diameter of about 0,11 mm. The entrance of the uterus into the sac is immediately subterminal and anterior.

So far as is known, the adult of this species occurs naturally in ciconiiform birds in southern Europe, eastwards to the Indo-Malaysian region and over the whole of Africa. The worm has also been found naturally and experimentally in pelecaniform birds in India and West Africa, but in each case the parasite seemed not to have reached maturity, and its growth appeared to have been stunted, which suggests that pelecaniform birds might not be normal hosts of *Euclinostomum heterostomum*.

With the exception of the sporocyst, the developmental stages in the life-history of *Euclinostomum heterostomum* have been recognized, and the metacercaria is known to occur embedded in the liver, or encapsulated on the surface of the kidneys, mesenteries, small intestine or in the muscles of the coelomic wall of various freshwater fishes. In Africa, the primary second intermediate hosts appear to be clariid, silurid and cichlid fishes, but a metacercaria of this parasite from *Barbus pallidus* in the Zwartkops River, Uitenhage, Cape Province, is in the helminthological collections of the British Museum (Natural History). It is also worthy of mention that Lombard (1968) found *Euclinostomum* metacercariae embedded in the tissues of various species of *Tilapia* in the Transvaal.

From Prudhoe and Hussey, 1977

Euclinostomum heterostomum (Rudolphi, 1809) Travassos, 1928

(Fig. 56)

The following study is based on two metacercariae recovered from the body cavity of one specimen of *Channa* (*Ophicephalus*) *marulius* from Lahore. These worms were found encapsulated on the tissue of ovary of the host.

The body of the worm is elongated with a truncated anterior end and a broadly rounded posterior end. The maximum breadth of the body is at about the equator of the post-acetabular region of the worm. The tegument is thin and unarmed. The oral sucker is terminal and is surrounded by an oral field. In live condition the oral sucker may protrude beyond the anterior truncated end. The spherical ventral sucker is about 4 times as large as the oral and is situated near the anterior end. A distinct prepharynx is present. The pharynx is feebly developed. The oesophagus is absent. The intestinal caeca extend to near the posterior end and bear 10-11 lateral diverticula on each side none of which is branched.

56

The gonads are roughly in the middle third of the post-acetabular region of the body. The testes are tandem. The anterior testis is somewhat crescentic in shape; while the posterior testis is roughly triangular in shape and smaller than the anterior testis. The cirrus sac is small and is lodged in the concavity of the anterior testis. The vesicula seminalis, ductus ejaculatorius and cirrus have not yet been fully formed. The ovary is nearly spherical, intertesticular, but nearer the anterior testis and slightly lateral to the median line. The shell gland is well-developed and posteromesial to the ovary. The vitellaria have not yet properly been formed. The uterine sac is tubular, median, extending from a little behind the ventral sucker to immediately in front of the cirrus sac. The utero-duct opens into the uterine sac near its anterior end. Eggs have not yet been formed. The excretory vesicle is Y-shaped.

MEASUREMENTS

(All measurements in millimetres)

Body length	3.999 – 5.393
Body breadth	1.242 – 1.878
Oral sucker	0.147 – 0.225 × 0.205 – 0.245
Ventral sucker	0.818 – 0.909 × 0.848 – 0.909
Prepharynx	0.071 – 0.098
Pharynx	0.114 – 0.122 × 0.096 – 0.102
Anterior testis	
At middle	0.107 – 0.156 × 0.343 – 0.408
At sides	0.225 – 0.343 × 0.343 – 0.408
Posterior testis	
At middle	0.186 – 0.294 × 0.274 – 0.362
At sides	0.215 – 0.372 × 0.274 – 0.362
Ovary	0.114 – 0.147 × 0.107 – 0.137
Uterine sac	0.684 – 0.999

Host: *Channa* (*Ophicephalus*) *marulius*

Location: Body cavity (Encapsulated on the tissue of ovary)

Locality: Lahore

Discussion

The parasite under study resembles *Euclinostomum heterostomum* (Rudolphi, 1809) Travassos, 1928 as described by Fischthal and Kuntz (1963b) in all essential features. However, this species is being reported for the first time from Pakistan.

From BHUTTA AND KHAN, 1975

Indian Journal of Helminthology, Vol. X, No. 1, March 1958 pp. 31—39.

FURTHER OBSERVATIONS ON *EUCLINOSTOMUM INDICUM* (BHALERAO, 1942) (TREMATODA : CLINOSTOMATIDAE)

By

S. M. AGARWAL

Department of Zoology, M. M. V., Jabalpur.

The genus *Euclinostomum* (Travassos, 1928) includes five metacercarial forms viz. *E. heterostomum* (Rud., 1809), *E. africanum* (Galli-Valerio, 1906), *E. clarias* (Dubois, 1929), *E. multicaecum* (Tabangui and Masilungan, 1935) and *E. indicum* (Bhalerao, 1942). Of these, the adult form of only one species i.e. *E. heterostomum* (Rud., 1809), has been described so far by Dollfus (1950) from 3 specimens (two fully mature, while the third immature).

In this paper the adult form of *E. indicum* (Bhalerao, 1942) is described. They were collected from the mouth cavity of my experimental herons, *Bubulcus ibis*, which were fed with fish, *Ophiocephalus punctatus*. The parasites in my collection are at different stages of maturity. Of the twelve parasites collected, three are fully mature with a large number of eggs in their uterus, three are on the verge of becoming mature while the rest six are very immature, presumably not very much different from the metacercariae. The size of the body of the above parasites and also their host, led to a critical comparison of the above forms with *E. indicum* (Bhalerao, 1942) and it seems reasonable to believe that they are advanced stages of development of *E. indicum* (Bhalerao, 1942).

KEY TO THE KNOWN FORMS OF METACERCARIA BELONGING TO THE GENUS *EUCLINOSTOMUM* (TRAVASSOS 1928).

Uterus reaching only slightly beyond the middle of the body length : the distance between suckers less than that between the uterine-sac and the ventral sucker.....1.

Uterus reaching almost the posterior border of the ventral sucker ; distance between suckers more than that between the v. s. and uterine-sac.....2.

1. Gonads in the middle third of the body ; lateral branches of the intestinal caeca very long, reaching the posterior end of body.....
E. multicaecum (Tabangui and Masilungan, 1935.)

Gonads in the posterior third of the body, lateral branches of the intestinal caeca normal.....*E. clarias* (Dubois, 1929).

2. Body comparatively smaller ; pharynx well developed, vitelline-reservoir present, anterior testis with sacculations, ovary lobed...*E. indicum* (Bhalerao, 1942).

Body large, pharynx rudimentary or absent, vitelline reservoir absent, ovary and testes smooth.....*E. heterostomum* (Rudolphi, 1809).

(N. B.—Galli-Valerio (1906) described *C. africanum* which was later identified as *E. africanum* by Dollfus in 1950 ; but its description is not enough to permit assigning a correct position to it in the above key.)

KEY TO THE KNOWN FORMS OF ADULTS BELONGING TO THE GENUS *EUCLINOSTOMUM*.

1. Uterus reaching the posterior border of ventral sucker, so that distance between suckers larger than that between the uterine-sac and ventral sucker.....2.

2. Pharynx well developed and thickly muscular ; vitelline reservoir conspicuous.....*E. indicum* (Bhalerao, 1942).

Pharynx rudimentary or absent ; vitelline reservoir absent.....
E. heterostomum (Rudolphi, 1809).

N. B.—Dollfus (1950) described 3 specimens, two fully matured and one immature, as *E. heterostomum*. They have fairly large size and in all the three specimens the uteroduct opens at about the level of the middle of the uterine sac as against its opening at the tip of the uterine sac in *E. heterostomum* and *E. indicum*. In my opinion the above forms of Dollfus should be given a new specific status on account of its differences in the size of body, the point of opening of the uteroduct in the uterine sac, the position of gonads and also the comparative sizes of the testes.

SOME METACERCARIAL FORMS OF *CLINOSTOMATIDAE* (TREMATODA) FROM INDIA

By G. D. Bhalerao, D.Sc., Ph.D., F.Z.S., F.R.M.S., F.A.Sc.
[*Research Officer (Helminthology), Imperial Veterinary Research Institute, Izatnagar*]

Received May 5, 1942

Euclinostomum indicum ~~n. sp.~~ Bhalerao, 1942

A few specimens were obtained from the cœlomic cavity of *Ophiocephalus punctatus* in Poona. The worms are thick and fleshy with both extremities bluntly rounded. The anterior end and the sides of the body are bent ventrally. They measure 4·5 mm. in length and 1·72 mm. in maximum breadth. The oral sucker is terminal and measures 0·22 mm. in diameter. The prepharynx is small, being only 0·085 mm. long. The pharynx measures 0·043 × 0·062 mm. The œsophagus is very short and can be seen only in sections. The intestinal cæca pass up to the posterior end of the body. Each cæcum has eight branches externally, of which the fifth divides into two small sub-branches distally. The ventral sucker is situated in the second fifth of the body and measures 0·75 mm. in diameter. The excretory pore is situated subterminally at the posterior end of the body on the dorsal side. The excretory bladder is small and gives out two lateral branches which ramify profusely in the body.

The gonads are situated in the fourth fifths of the body and the testes are tandem. The anterior testis is more or less W-shaped and measures 0·18 × 0·6 mm. The posterior testis is Y-shaped and measures 0·265 × 0·5 mm. The cirrus sac lies horizontally in front of the anterior testis and contains a coiled vesicula seminalis, the pars prostatica and a small ductus ejaculatorius. The pars prostatica is surrounded by the prostatic cells. The genital pore is situated 0·10 mm. behind the acetabulum.

The ovary is almost round, measures 0·165 × 0·135 mm. and is situated in the inter-testicular area, slightly to the right of the middle line. A very thin, sinuous oviduct emerges from the ovary and after a short distance dilates into the oötype which is surrounded by the cells of the shell gland, the latter measuring 0·1 × 0·055 mm. A somewhat thicker oviduct coils in the inter-testicular area and continues as the utero-duct which curves on the left side of the anterior testis and continues to meet the uterus at its anterior end. The uterine sac is 0·75 mm. long and terminates 0·3 mm. behind the ventral sucker, at about the anterior two-fifths of the body.

Up to the present time, only three species of *Euclinostomum* have been recorded, *viz.*, *E. heterostomum* (Rudolphi, 1809), *E. clarias* (Dubois 1929) and *E. multicæcum* (Tubangui and Masilungan, 1935). From these species, the present form can be distinguished by the anterior extent of the uterine sac which terminates at about the anterior tow-fifths of the body. Moreover in the last two species the cirrus sac has not been mentioned. The gonads in the present species lie in the fourth fifths of the body. In the location of the cirrus sac, it resembles *E. heterostomum* but, as has been already mentiond, it differs from it in the anterior extent of the uterine sac and the utero-duct. The ratio of the oral to the ventral sucker in *E. heterostomum* is 1 : 4·5, whereas in the present form it is 1 : 3. From this it is clear that the species in question is a new one, for which the name *Euclinostomum indicum* is proposed.

Dorsal view of *Euclinostomum indicum* n. sp.

from: Agarwal, 1958

EUCLINOSTOMUM INDICUM (Bhalerao, 1942).

Body is broad and rounded at both ends, measuring 6.02 by 2.52 mm. in size. Cuticle non-spiny.

Oral sucker encircling the mouth, measures 0.234 by 0. 26 mm. Ventral sucker situated 0.819 mm. from the oral sucker, bordering the anterior two-fifth of the body and measures 1.066 by 1.092 mm. It is about 4-4.5 times larger than the oral sucker.

Mouth leads into a prepharynx which is 0.182 mm. long. Pharynx conspicuous, thickly muscular, measuring 0.143 by 0.169 mm. and opening directly into the intestinal caeca. Oesophagus seems to be absent. Intestinal caeca long and sinuous upto the posterior border of the ventral sucker and then give out lateral branches on the external side. The number of branches is 10 and 11, but their number is variable in the range of 9-13.

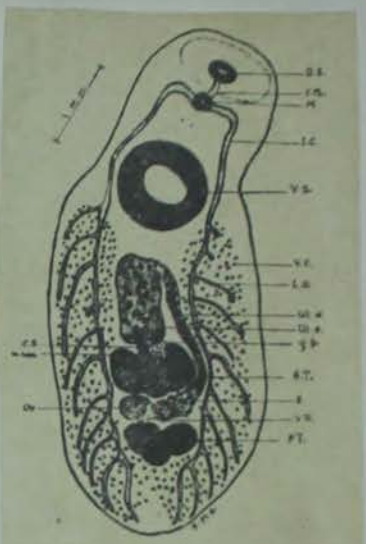
Gonads are situated in the posterior four-fifth of the body, occupying an area of 1.43 mm.

Anterior testis U shaped, 0.975 mm. broad and 0.53 & 0.52 mm. long at the two ends and 0.273 mm. in the centre. It has sacculations on its posterior border but otherwise has a smooth outline. Posterior testis Y—shaped, 3 lobed and measures 0.455 by 0.871 mm. in size.

Cirrus-sac is situated between the two limbs of the anterior testis and measures 0.273 by 0.286 mm. It has a lobed vesicula seminalis, pars prostatica and a cirrus inserted in the metraterm.

Ovary is slightly lobed, measures 0.26 by 0.338 mm.; oviduct arises from its inner border; Ootype in the centre of the intertesticular space; uteroduct opening in the uterine-sac at its tip near the ventral sucker; uterine-sac 0.338 mm. removed from the ventral sucker. Egg 0.117 by 0.065 mm. in dimensions, elliptical and operculate. Genital pore just above the cirrus sac and measuring 0.104 by 0.13 mm. in size.

Vitellaria commence from behind the ventral sucker, overlap the intestinal caeca and its branches, are confluent in the post-testicular region extending upto the terminal ends of the branches of the caeca in the posterior end of body. Vitelline reservoir well developed measuring 0.078 by 0.195-0.247 mm. Excretory bladder 'V' shaped.



Mature form.

Immature form.

eggs of E. indicum
acc to Basu, Bhalerao & Kunty (1943)

DESCRIPTION OF IMMATURE FORMS.

Body—3.267-6.88 mm. long and 1.32-2.8 mm. broad.

Suckers—Oral sucker, 0.13-0.221 mm. by 0.208-0.286 mm. Ventral sucker 0.637-1.17 mm. by 0.676-1.27 mm., about five times as long as the oral sucker and 3 to 4 times as broad as the oral sucker. It is situated 0.364-0.715 mm. from the oral sucker, occurring at the anterior two-fifth of the body.

Gut—Mouth leads into the prepharynx which is 0.065-0.13 mm. long; pharynx prominent, thickly muscular, measuring 0.104-0.143 mm. by 0.143-0.221 mm.; oesophagus absent; number of branches from the intestinal caeca varying, 10-10, 10-11, 11-12, 10-13 and 12-13 in five specimens examined.

Gonads—Situated in the posterior four-fifth of the body.

Testes—Anterior testis 'U'-shaped, with a number of sacculations or pouches on its posterior margin. It measures 0.39-0.844 mm. broad. Posterior testis 'Y'-shaped, three lobed, measuring 0.208-0.325 by 0.115-0.299 mm.

Cirrus sac in the space between the two limbs of the 'U' shaped anterior testis, measures 0.104-0.263 by 0.13-0.221 mm. Vesicula seminalis bilobed, occupying major portion of the cirrus-sac. Pars prostatica present; cirrus proper appears to be inserted in the metraterm in some specimens.

Ovary many lobed; measures 0.104-0.195 by 0.104-0.247 mm. Details of the ootype similar to the description of the adult. Uteroduct opening at the tip of the uterine sac. Uterine sac 1.167-3.306 mm. long and is situated 0.299-0.585 mm. from the ventral-sucker. Genital pore measuring 0.039-0.078 by 0.065-0.091 mm. and situated just in front of the cirrus-sac.

Vitellaria not very distinct but seem to have the pattern of the adult.

The studies of the immature forms reveal some interesting differences from the description of E. *indicum* (Bhalerao, 1942), viz. the ratio between the suckers is 1 : 4-4.5 here (Bhalerao mentioned it as 1 : 3), the size of the pharynx is much larger, the variable number of lateral branches from the intestinal caeca (Bhalerao noted only 8 caecal branches in the metacercarial form), the anterior testis peculiarly gives out numerous lobes only on its posterior border, and lastly the lobed nature of the ovary. During the growth of these forms into adults the testes become smooth, vitelline follicles with the vitelline reservoir become distinct and the uterus gets filled with eggs.

Host—*Bubulcus ibis*.

Location—Mouth cavity, attached at the base of the tongue.

DISCUSSION

The adult form of *E. indicum* (Bhalerao, 1942) resembles the only other known species, *E. heterostomum* (Rud., 1809) within the genus *Euclinostomum* (Travassos, 1928), in the general form of the body, the pattern of the internal organs, such as the nature of intestinal caeca and its branches, the commencement and distribution of the vitelline follicles, the position of the gonads in the posterior four-fifth of the body, the uteroduct opening at the tip of the uterine-sac, the distance between the uterine-sac and the ventral sucker which is less than that between the two suckers, the ratio between the two suckers and also the general characters of the cirrus-sac, etc.

It differs from *E. heterostomum* (Rud., 1909) in the generally smaller size of its body and most pertinently in the presence of a well developed, thickly muscular pharynx both in the metacercaria as well as in the adult and the presence of a distinct and well developed vitelline reservoir. In view of the above characters, particularly the conspicuous pharynx and vitelline reservoir in the adult, *E. indicum* (Bhalerao, 1942) can easily be distinguished from *E. heterostomum* (Rud., 1809).

The presence of a pharynx and the absence of an oesophagus are very significant points in the above study. It seems reasonable to consider the structure between the mouth and the point of intestinal bifurcation in those forms of Clinostomes where the pharynx is rudimentary or absent, as prepharynx, rather than as oesophagus which has been the practice (Rudolphi, MacCallum, Johnston, Hunter and Hunter and Yamaguti in the case of *C. marginatum*; Singh 1952 in the cercaria of *C. hunterii*; Rudolphi and Dollfus in the case of *E. heterostomum* and Dollfus in the case of *Clinostomoides*).

I have in my collection immature and adult specimens of *E. indicum* (Bhalerao, 1942), the metacercaria and adult specimens of *E. heterostomum* (Rud., 1809), the cercaria, metacercaria and adult stages of the life-history of *C. giganticum* and a metacercaria belonging to the genus *Clinostomoides* (Dollfus, 1950). My study of all the above forms has brought out that *E. indicum* has a well developed and thickly muscular pharynx immediately entering the intestinal bifurcation both in the metacercaria as well as in the adults; *E. heterostomum* has no pharynx and the long tubular prepharynx (termed as oesophagus) entering the intestinal bifurcation both in the metacercariae as well as in the adult forms; in some forms has a bulbous dilatation beneath the long and tubular prepharynx (considered as oesophagus in the case of Cercaria *Clinostomum hunteri* Singh, 1953) just above the undivided caecum, in the cercaria while the same dilatation is continued in a similar way in the metacercaria and adult condition, a muscular pharynx being not represented in any of the above stages in this life-history; and in the metacercaria belonging to the genus *Clinostomoides* (Dollfus) and also in the type-species described by Dollfus (1950) the long preharynx (regarded as oesophagus by Dollfus, 1950) bifurcates into the intestinal caeca without the interpolation of a dilatation or a pharynx.

The above study makes me think that the oesophagus is absent or almost absent in all the Clinostomes. What is present, is the prepharynx which in some forms (e.g. *Euclinostomum indicum*) has a thick muscular pharynx behind it, in some other forms (*C. marginatum* Rud. 1809,;) has a bulbous dilatation behind it and in still other forms (*Clinostomoides brieni*, Dollfus 1950; *E. heterostomum*, Rud. 1809 and the metacercaria *Clinostomoides dollfusi* n. sp.) there is no pharynx and neither any dilatation.

Thus it is probable that the Clinostomes have three kinds of cercariae, viz. with a thick muscular pharynx (*Euclinostomum-indicum* type), with just a bulbous dilatation behind the prepharynx (*Clinostomum* type) and without a pharynx or even a dilatation (*E. heterostomum* type and *Clinostomoides* type) and depending upon the nature of cercaria in regard to this structure, the metacercaria and the adult would show corresponding features.

La Rue (1938) after having studied the description of the pharyngeal *Cercaria* of *C. marginatum* (Krull, 1934; Hunter and Hunter, 1935) and the apharyngeal adult, *C. marginatum* (Rud., 1809; Yamaguti, 1934; Hunter and Hunter 1934-35) raised a question as to whether it is possible that the pharynx degenerates during the long metacercarial period? The above discussion provides a clue for the answer of this question. It seems to me that the *Cercaria* of *C. marginatum* (Krull, 1934) may have a dilatation before the undivided caecum which has persisted in the metacercaria and the adult in a similar fashion. This dilatation, I believe, has been referred by Krull as pharynx and hence the confusion. A similar confusion has been made in the case of *Cercaria* of *C. hunteri* (Singh, 1952) where it has been stated, "it seems that the bulbous dilatation beneath the oesophagus may represent the pharynx." In my opinion, there is no degeneration of the pharynx during the metacercarial stage. Its presence or absence depends on its condition in the cercarial stage. Clinostomes thus become very interesting in that pharyngeal, apharyngeal as well as intermediate condition in regard to this structure, are exhibited by the members belonging to it. They were held to be very similar to the Schistosomes on account of the absence of a pharynx in the adult but the present study reveals that too much significance need not be attributed to the nature of the pharynx. It seems that variations in regard to this point are possible within a group. Even among the Strigeids apharyngeal condition is known to occur in *Apharyngostrigea*. The Clinostomes may be considered interesting on account of the absence of oesophagus also.

Euclinostomum indicum marulii, ~~subsp. n. (Fig. 2 e)~~ Bilqees, 1972

Type host: *Ophiocephalus marulius* (Ham); other hosts: *O. striatus* and *O. gachua*.

Location: mesentry in the type host, and mesentry and liver in other hosts.

Locality: Haleji Lake and Kalri Lake, W. Pakistan.

Number: 69 specimens from 27 type hosts.

Stout, linguiform, thick and fleshy with both extremities bluntly rounded; posterior end broader. In a living specimen the anterior end and sides of the body bent ventrally. Length 7.7–9.97, width 2.91–3.23. Oral sucker subterminal, small, 0.187×0.27–0.21×0.28, surmounted by a thick fold of body wall. Pharynx small 0.06×0.08–0.07×0.09. Oesophagus small, tubular, 0.1×0.2–0.11×0.03 in size. Caeca long and delicate, reaching to posterior extremity with 9 or 10 uniformly thick lateral branches, the first being usually small, the middle ones longer and the posterior again smaller. In the type specimen there are 9 lateral branches if the minute second on the right and fourth on the left is not counted. Acetabulum in anterior third of body, many times larger than oral sucker, 1.36×1.4–1.5×1.55. Sucker ratio 1 : 5–1 : 55. Testes in posterior half of body; anterior testis in posterior third and the posterior one in posterior quarter of the body. Both transversely elongated, irregular in outline, intercaecal. Anterior testis 0.28×0.75–0.45×0.96, posterior 0.25×0.6–0.4×0.85. Cirrus sac in front of anterior testis, genital atrium circular, genital pore median. Ovary rounded or sligtly irregular, 0.18×0.186–0.214×0.216 in size, intertesticular, submedian, to the right of middle line. Thicker oviduct coils in the intertesticular area and continues as the uterine duct which curves on the left side of the anterior testis meeting the uterine sac. The uterine sac 1.6–1.8 long, terminating 0.4–0.55 behind the acetabulum. Vitelline follicles extending up to the posterior border of acetabulum, mostly in the extracaecal zone, confluent behind excretory pore. Excretory opening dorsal and subterminal.

Remarks: *Euclinostomum indicum marulii* subsp. n. is closely related to *E. indicum* Bhalerao, 1942 as far as the general shape of body, position of testes and cirrus sac and the anterior extent of the uterine sac are concerned, but is separated from the latter due to 9–10 lateral branches of caeca, much larger body and different sucker ratio. *E. indicum* has 8 lateral branches of caeca and the sucker ratio 1 : 3, while the ratio of oral sucker to acetabulum in the subspecies is 1 : 5–1 : 55. The host species is also different for the two, although it is quite possible that the new subspecies also occurs in *Ophiocephalus punctatus*, but at present this fish species is not available to acertain this assumption. The location of the subspecies is, the same as that of *E. indicum* in the type host but it was also recovered from the liver of other host species.

Euclinostomum minutus ~~n. sp.~~ BHUTTA AND KHAN, 1975

(Fig. 55)

The following account is based upon six worms (4 mature and one immat recovered from the intestine of one specimen of *Ardea cinerea* from Panjnad Headwc area.

55

The body of the worm has a truncated anterior end and a constriction at ab the level of the ventral sucker. The posterior end is broadly rounded. Maxim breadth of the body is at about the middle of the postacetabular region. tegument is thin and unarmed. The oral sucker is terminal and is surrounded l prominent oral field. The ventral sucker is well-developed, 2.36 – 3.9 times the of the oral and is nearer the anterior extremity, at about one sixth of the b length from the latter. The pharynx is absent. The oesophagus is short and div into two intestinal caeca which extend to near the posterior end of the body. Bel the ventral sucker the caeca are irregularly diverticulated but the diverticula present only on their outer surfaces. The number and arrangement of the diverti of one caecum may differ from those on the other side. The number of diverticula r vary from 12-15 on each side.

The testes are placed almost tandem in the posterior half of the body. anterior testis which is little behind the equator is semicircular in shape. The p erior testis is roughly triangular in shape. The cirrus sac is median and close in front of the anterior testis and is hardly visible in older specimens du the presence of a large number of eggs. Enclosed within the cirrus sac are a vesicula seminalis, ductus ejaculatorius and a cirrus. The genital pore is median, at the level of the anterior margin of the anterior testis. The ovary is intertesticular, slightly lateral to the median line and is considerably smaller than the testes. The vitellaria are follicular, extending from just behind the ventral sucker to the posterior end of the body. They are largely extracaecal to the level of the testes but behind the testes the vitellaria of the two sides become confluent. The uterine sac in the immature specimen is tubular and median, extending from the anterior level of the anterior testis to a little behind the ventral sucker. In older specimens the uterine sac occupies almost whole of the space between the ventral sucker and the anterior testis and is full of eggs. In such specimens the entire extent of the uteroduct obliterated from the view and in none of such specimens it was possible for us to see the opening of the uteroduct into the uterine sac, whereas in the immature specimen the uteroduct was clearly visible to open into the uterine sac near its anterior end. A short metaterm is present. The eggs are oval, large, light yellow in colour, operculate and embryonated. The excretory vesicle is Y-shaped.

Host: *Ardea cinerea*
Location: Intestine
Locality: Panjnad Headworks area

Discussion

Only one species known as adult (*E. bhagavantami*) and only two metacercari, *E. heptacaecum* and *E. channai* (if *E. channai* is to be regarded as a valid species) are without pharynx. *E. bhagavantami* differs from the present species and all the other previously known species in the position of the opening of its uteroduct into the uterine sac (if this character has been correctly interpreted by Jaiswal, 1958). It also differs from the present species in being much larger. None of the two metaceracriae, *E. heptacaecum* and *E. channai* could belong to the present species because they are much larger with larger organs as metacercariae than the species under study which is adult. In view of these differences it is felt that a new species is being dealt with for which the name *Euclinostomum minutus* is proposed.

MEASUREMENTS

(All measurements in millimetres)

Body length	4.484 – 6.666
Body breadth	1.666 – 2.424
Oral sucker	0.235 – 0.392 × 0.245 – 0.392
Ventral sucker	0.818 – 0.909 × 0.818 – 0.909
Ovary	0.245 – 0.333 × 0.235 – 0.393
Shell gland	0.272 – 0.454 × 0.272 – 0.575
Anterior testis	0.363 – 0.636 × 0.545 – 0.999
Posterior testis	0.363 – 0.606 × 0.484 – 0.969
Eggs	0.051 – 0.130 × 0.051 – 0.076

Clinostomidae

Euclinostomum multicaecum Tubangui & Masilungan, 1935

Family CLINOSTOMIDÆ Luehe, 1901

EUCLINOSTOMUM MULTICÆCUM n. sp. Figs. 1 to 3.

This parasite is the second metacercarial form to be reported from the fresh-water fish *Ophicephalus striatus*, the first one being *Clinostomum dubyi* Tubangui, 1933. It belongs to the genus *Euclinostomum*, the members of which were separated by Travassos (1928) from the old genus *Clinostomum* Leidy, 1856, due to the presence of long cæcal diverticula. It differs from *Euclinostomum heterostomum* (Rudolphi, 1809) in the extent of its uterus which reaches anteriorly only slightly beyond the middle of the body length and not to the posterior border of the acetabulum as in the case of *E. heterostomum*. In that respect it resembles *E. elorius* (Dubois, 1929), a metacercaria found in the body cavity of another fish, *Clarias angolensis*. Dubois' original description is not available to the writers, but according to Baer (1933) the genital organs of *E. elorius* are located in the posterior third of the body length, while those of the Philippine species are situated in the middle of the body length.

Description.—Body elongate, rounded at both ends, 10.5 to 13.0 millimeters in length by 3.7 to 4.5 millimeters in maximum breadth across middle of body length. Cuticle unarmed. Oral sucker terminal, weak, 0.5 to 0.7 millimeter across. Acetabulum well developed, in middle of anterior third of body length, mous-

wrong figure

Reference: Philipp.Jour.Sci.,58:435-444. 1935

A REDESCRIPTION OF EUCLINOSTOMUM MULTICÆCUM TUBANGUI AND MASILUÑGAN, 1935 *

(TREMATODA: CLINOSTOMIDÆ)

Tubangui and Masiluñgan(19) described as *Euclinostomum multicæcum* a trematode encysted in the muscular tissues of *Ophicephalus striatus* Bloch collected from Baao, Camarines Sur, Luzon. It is unfortunate that the senior author is now deceased, otherwise pertinent data with respect to the parasite could have been available. Moreover, the type specimens in the Bureau of Science parasitological collection, according to the junior author, were completely lost during the battle of Manila in World War II.

The description and illustration of *Euclinostomum multicæcum*, therefore, is the only basis of comparison with those of the present specimens obtained from *Ophicepahlus striatus* collected from Laguna de Bay, Laguna Province. The following description is based on the presently collected specimens. These were flattened, fixed in Bouin's picro-formol, stained in Semichon's carmine and mounted in toto.

EUCLINOSTOMUM MULTICÆCUM Tubangui and Masiluñgan.

Description.—Body elongate, rounded at both ends but much wider anteriorly than posteriorly; measuring from 9 to 12 mm

* Department of Zoology, University of the Philippines Parasitological Collection Nos. 201 and 308.

- OVER -

in length by 3 to 4 mm in maximum width. Cuticle unarmed; oral sucker rather weak and terminal, 0.6 to 0.7 mm across; acetabulum well developed, in anterior fourth of body, measuring about 1.4 to 1.43 by 1.39 to 1.47 mm. Prepharynx, rudimentary, about 0.25 to 0.28 mm in length just anterior to the bulblike pharynx, 0.15 to 0.196 by 0.2 to 0.22 mm; oesophagus short, hardly discernible. Intestinal crura rather prominent with long diverticula in postacetabular region extending to the posterior end of the body. Some of the diverticula are forked distally at level of or anterior to the uterine sac, at the level of the testis and also the distal fourth of the body (Plate 1, fig. 5; Plate 2, fig. 2). On either side of the body and emerging from behind the intestinal crura at about the level of the acetabulum are the lateral excretory vessels which extend posteriorly and open into the median, postero-dorsal excretory pore. Reserve excretory system well distributed.

Testes tandem in the posterior part of the middle third of the body; anterior testis broadly U-shaped, 0.154 to 0.196 by 1.12 to 1.48 mm; posterior testis crescentic with a small knoblike projection directed posteriorly, 0.17 to 0.35 by 0.62 to 0.66 mm; cirrus pouch just above the anterior testis enclosing a coiled vesicula seminalis and a cirrus opening immediately below the uterine sac opening. Between the testis towards the right side of the median line, is the irregularly shaped ovary, 0.168 to 0.238 by 0.084 to 0.126 mm, Laurer's canal present; the much coiled uterine duct occupying the median region between the two testes; after coiling considerably, the uterine duct ascends towards the left about midway between the acetabulum and gonads, then loops downward to form the uterine sac, 1.2 to 1.58 mm long, ending at the uterine opening immediately adjacent to the cirrus opening at the genital atrium (Pate 2, fig. 2, and Plate 3, fig. 5).

Vitellaria profuse, finely granular, postacetabular, occupying all spaces not occupied by other organs.

DISCUSSION

Euclinostomum multicaecum as described by Tubangui and Masiluñgan,(19) is strikingly similar to the specimens herein redescribed except for the following: (*1*) my specimens were immediately set free upon cutting the visceral lining of the fish where as those of Tubangui and Masiluñgan were reported as encysted; (*2*) the forking of the intestinal diverticula is somewhat different; (*3*) the coiling of the uterine duct is not shown in the description of Tubangui and Masiluñgan but was doubtless similar to that noted in this description; and (*4*) the cirrus pouch, together with the vesicula seminalis and cirrus, and the position of the genital atrium were not described. The species described by Tubangui and Masiluñgan probably is identical with the specimen described by me but certain anatomical parts were misinterpreted or not seen.

VELASQUEZ, 1960

From Velasquez, 1960. Philippine Jour. Sci. 87(4)

A REDESCRIPTION OF EUCLINOSTOMUM MULTICÆCUM TUBANGUI AND MASILUÑGAN, 1935 *

(TREMATODA: CLINOSTOMIDÆ)

Tubangui and Masiluñgan(19) described as *Euclinostomum multicæcum* a trematode encysted in the muscular tissues of *Ophicephalus striatus* Bloch collected from Baao, Camarines Sur, Luzon. It is unfortunate that the senior author is now deceased, otherwise pertinent data with respect to the parasite could have been available. Moreover, the type specimens in the Bureau of Science parasitological collection, according to the junior author, were completely lost during the battle of Manila in World War II.

The description and illustration of *Euclinostomum multicæcum*, therefore, is the only basis of comparison with those of the present specimens obtained from *Ophicephalus striatus* collected from Laguna de Bay, Laguna Province. The following description is based on the presently collected specimens. These were flattened, fixed in Bouin's picro-formol, stained in Semichon's carmine and mounted in toto.

EUCLINOSTOMUM MULTICÆCUM Tubangui and Masiluñgan.

Description.—Body elongate, rounded at both ends but much wider anteriorly than posteriorly; measuring from 9 to 12 mm in length by 3 to 4 mm in maximum width. Cuticle unarmed; oral sucker rather weak and terminal, 0.6 to 0.7 mm across; acetabulum well developed, in anterior fourth of body, measuring about 1.4 to 1.43 by 1.39 to 1.47 mm. Prepharynx rudimentary, about 0.25 to 0.28 mm in length just anterior to the bulblike pharynx, 0.15 to 0.196 by 0.2 to 0.22 mm; oesophagus short, hardly discernible. Intestinal crura rather prominent with long diverticula in postacetabular region extending to the posterior end of the body. Some of the diverticula are forked distally at level of or anterior to the uterine sac, at the level of the testis and also the distal fourth of the body (Plate 1, fig. 5; Plate 2, fig. 2). On either side of the body and emerging from behind the intestinal crura at about the level of the acetabulum are the lateral excretory vessels which extend posteriorly and open into the median, postero-dorsal excretory pore. Reserve excretory system well distributed.

Testes tandem in the posterior part of the middle third of the body; anterior testis broadly U-shaped, 0.154 to 0.196 by 1.12 to 1.48 mm; posterior testis crescentic with a small knoblike projection directed posteriorly, 0.17 to 0.35 by 0.62 to 0.66 mm; cirrus pouch just above the anterior testis enclosing a coiled vesicula seminalis and a cirrus opening immediately below the uterine sac opening. Between the testis towards the right side of the median line, is the irregularly shaped ovary, 0.168 to 0.238 by 0.084 to 0.126 mm, Laurer's canal present; the much coiled uterine duct occupying the median region between the two testes; after coiling considerably, the uterine duct ascends towards the left about midway between the acetabulum and gonads, then loops downward to form the uterine sac, 1.2 to 1.58 mm long, ending at the uterine opening immediately adjacent to the cirrus opening at the genital atrium (Pate 2, fig. 2, and Plate 3, fig. 5).

Vitellaria profuse, finely granular, postacetabular, occupying all spaces not occupied by other organs.

Euclinostomum multicaecum Tubangui and Masilungan, 1935
FROM: Purnomo, W.P. Carney, and E.E. Stafford 1978

Euclinostomum multicaecum was first described by Tubangui and Masilungan (1935) from metacercariae encysted in the muscles of fish, *Channa (Ophicephalus) striatus*, from the Philippines. Subsequently, Velasquez (1959) reported finding unencysted metacercariae beneath the visceral peritoneum of the same host species.

In July 1973, 20 adult specimens of *E. multicaecum* were recovered from the esophagus of three herons, *Ardea purpurea*, collected near Paku and Muara in the Lindu Valley of Central Sulawesi, Indonesia. All worms were fixed and preserved in 10% formalin. Whole mounts were stained with Gower's carmine; histological sections were stained with H&E. Drawing was prepared with the aid of a Bausch & Lomb microprojector. Measurements are in millimeters.

Figure 1. *Euclinostomum multicaecum* from the esophagus of a purple heron (*Ardea purpurea*), Sulawesi, Indonesia (ventral view).

Results

DIAGNOSIS: Measurements were derived from 7 ovigerous specimens. Diagnosis otherwise based on study of 20 ovigerous specimens (Fig. 1).

Body fusiform slightly truncate at anterior end, broad at middle and rounded at posterior end, with maximum width occurring at region of anterior testis. Body wall at anterior end invaginated to form a collar around a protrusible, broad and dome-shaped oral field. Integument spineless. Body length 16.3 (9.0–22.2), width 6.24 (5.1–7.5). Acetabulum large, 1.70 (1.5–2.0) × 1.71 (1.6–1.9), strong, in anterior fifth of body. Y-shaped excretory bladder opens into excretory pore on middorsal surface near posterior end.

Oral sucker subterminal, in center of oral field, length 0.71 (0.66–0.78), width 0.36 (0.30–0.45); ratio of length of oral to ventral sucker, 1 : 2.0–2.9. Prepharynx exits from the posteroventral margin of oral sucker and enters the pharynx at its ventroanterior end. Pharynx leads dorsally to bulb-shaped esophagus (not illustrated in Fig. 1 since it is dorsal to pharynx), 0.30 × 0.15 in dimension, from which cecal bifurcations originate. Each cecum forks into 2 primary lateral canals. Primary intestinal ceca extend posteriad, converge slightly mediad behind posterior testis and end blindly near posterior end. Primary intestinal ceca give rise to several secondary blind diverticula of unequal length, most of which extend to posterior end. Number of secondary diverticula vary, 7–10 on left, 8–10 on right (ventral view).

Reproductive organs intercecal in middle third of body. Ovary oval (0.35 [0.20–0.50] × 0.34 [0.20–0.48]) in intertesticular parenchyma slightly to right of median line. Oviduct arises from middorsal aspect of ovary. Laurer's

Figure 2

← Description on back of this page

~OVER~

canal branches from oviduct and terminates on middorsal surface. Vitelline follicles small, 0.07–0.06 in diameter, dispersed between primary and secondary ceca. Vitelline duct joins oviduct at junction of oviduct with ootype. Uterus originates as terminal coil of ootype, proceeds anteriad ventral to ootype but dorsal to left margin of anterior testis. Uterus turns abruptly approximately 2 mm in front of anterior testis and proceeds posteriad as a broad uterine sac, length 2.14 (1.15–3.20). A bulbous metraterm (0.30 × 0.24) arises from the ventroposterior limit of uterine sac and empties into a ventromedian genital-atrium. Testes tandem in posterior half of body. Anterior testis U shaped, length 1.05 (0.7–1.6), width 1.55 (0.9–2.0); posterior testis heart shaped, length 0.83 (0.5–1.25), width 1.31 (0.8–1.79).

HOST: *Ardea purpurea* (purple heron).

HABITAT: Esophagus.

LOCALITY: Paku and Muara, Lindu Valley of Central Sulawesi, Indonesia (1°19'S, 120° 04'E, 950 m).

PLESIOTYPES: Two specimens in USNM Helm. Coll. No. 74355. Remaining specimens in Helm. Coll., U.S. Naval Medical Research Unit No. 2, Jakarta Detachment, Indonesia. Nos. Djllv. 0029, 0035, 0036.

ATTACHMENT: *Euclinostomum multicaecum* was attached to host esophageal tissue by means of its acetabulum and oral field. The oral attachment, surprisingly, did not involve the oral sucker (Fig. 2). Instead, the tegument of the oral field adhered to the submucosa of the esophagus (Fig. 3).

The mucosa was eroded at the attachment site and the oral sucker interfaced directly with submucosal connective tissue. Adjacent to and surrounding the attachment site there was an extensive granulomatous reaction composed predominately of numerous foamy histiocytes. In addition, there were scattered mononuclear cells, both lymphoid and plasmacytic types, and occasional polymorphonuclear leucocytes. The attachment site was also characterized by necrosis and nuclear debris. Marked edema occurred in the surrounding tissues.

Discussion

Ukoli (1966) and Dennis and Sharp (1973) recognized only two species in the genus *Euclinostomum* Travassos (1928), namely *E. heterostomum*, and *E. multicaecum*. The adult morphology of *E. heterostomum* was carefully redescribed by Dennis and Sharp (1973). *Euclinostomum multicaecum*, however, was described from encysted and unencysted metacercarial stages (Tubangui and Masilungan, 1935; Velasquez, 1959). The most distinguishing feature of the metacercarial stage of *E. multicaecum*, by which it was distinguished from *E. heterostomum*, is that in the former all cecal diverticula reach the posterior end of the body. Our study of adult specimens corroborated the distribution of cecal diverticula as a distinguishing feature for ovigerous specimens of *E. multicaecum*. Ovigerous *E. multicaecum* can also be separated from *E. heterostomum* by the following: (1) The two main intestinal ceca do not form an H-shaped configuration; (2) the number of secondary cecal diverticula (ventral view) in *E. multicaecum* (8–10 right and 7–10 left) is less than in *E. heterostomum* (12–15 right and 9–12 left); and (3) adult specimens of *E. multicaecum* are larger (16.3 in length × 6.24 in width) than *E. heterostomum* (8.92 in length × 2.92 in width) as measured by Dennis and Sharp (1973).

The pharynx of *E. multicaecum* metacercariae was considered rudimentary (Tubangui and Masilungan, 1935; Velasquez, 1959). However, in adult specimens, as one might suspect, we observed a well-developed prepharynx, pharynx and a bulb-shaped esophagus similar to those described for *E. heterostomum* (Dennis and Sharp, 1973).

An adhesive function for the oral field of clinostomid trematodes has not been reported to our knowledge. In strigeoids an adhesive area, or organ, is a distinguishing feature and excorporeal digestion and absorptive functions are attributed to this organ (Erasmus, 1972). In our material, even though the epithelium of the host's esophagus had been eroded, the function of this area appeared to be one of attachment. Perhaps this phenomenon is related to the precarious habitat *E. multicaecum* occupies. Without such a strong attachment these flukes might be scraped off the oral or esophageal epithelium when fish or other bulky food were swallowed.

REF:
Proc Helminth
Soc Wash. 45(2):
171-174

Figures 2, 3. Attachment of *E. multicaecum* to esophageal tissues. 2. Sagittal section through oral region. 3. Oral field–esophagus interface. BM, blood meal; E, esophagus; I, interface of oral field and host esophageal tissue; HE, host esophageal tissue; OF, oral field; OS, oral sucker; P, pharynx; PP, prepharynx.

Jaiswal, 1957

Euclinostomum bhagavantami n. sp.

A solitary specimen of this species was obtained from the intestine of an Indian Reef Heron, *Demiegretta asha* in August, 1950.

This is a thin bodied trematode having a truncated and slightly attenuated anterior end, and a broadly rounded posterior end. It measures 12.37 mm. in length, maximum diameter being 3.37 mm. at about the level of the anterior testis. The cuticle is thin and non-spinous. The oral sucker is oval in shape and subterminal in position, measuring 0.53 by 0.38 mm. It is surrounded by a well differentiated oral field. In the live condition, the oral sucker was found alternately protruding from and retracting into the oral field. The acetabulum is well-developed and spherical in outline. It is placed roughly at about $\frac{1}{4}$th of the body length from the head-end, measuring 1.51 mm. in diameter. The suckers are roughly in the ratio of 1 : 3 and are separated from each other by a distance of 1.7 mm.

The pharynx was found to be lacking, a feature which is common to both *Clinostomum* and *Euclinostomum* species. The oral sucker is followed by a very short oesophagus, 0.2 mm. long, which divides immediately into two caeca running through the entire length of the body to the caudal end. In the post-acetabular region of the body the caeca are provided with numerous external diverticula, the presence of which distinguishes this genus from *Clinostomum*. The number of diverticula was found to differ on the two sides, there being 12 on the left side and 9 on the right. It was also noted that all the diverticula were simple unbranched, appearing as narrow tubes with distinctly swollen ends.

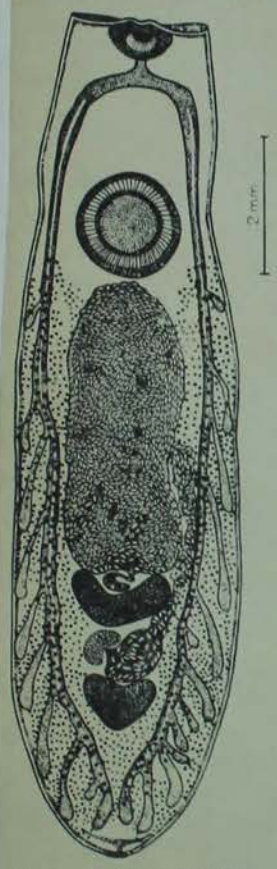


Fig. 8. *Euclinostomum bhagavantami* n. sp. Ventral View.

The excretory bladder is in the form of a Y with narrow limbs, and communicates with the exterior by means of a caudally placed median and terminal excretory pore.

The testes are arranged in tandem fashion, lying immediately behind the middle of the post-acetabular portion of the body. The anterior testis is in the form of a broad V, whilst the posterior one is heart-shaped, the two measuring 1.11 by 1.96 mm. and 1.96 by 0.91 mm. respectively. The cirrus sac is median and retort-shaped, lying in the concavity of the anterior testis. It encloses a seminal vesicle which is continued into a narrow ductus ejaculatorius, the terminal portion of which passes through a cirrus.

The ovary is kidney-shaped measuring [illegible] by 0.26 mm. and is placed lateral to the median line. The shell gland is of wide extent being bounded by the testes in front and behind and by the ovary and caecum on the sides. The oviduct arises from the middle of the concave surface of the ovary and is continued into the uterus which is tightly coiled in the region of the shell-gland and emerges anteriorly as the metraterm duct. The latter opens into the uterine sac laterally at its equatorial plane. The sac by means of a short and narrow metraterm communicates with the genital atrium. The common genital pore is located at about pharyngeal level of the anterior testis.

The vitellaria consist of small follicles distributed in the lateral zones of the post-acetabular portion of the body, converging posteriorly behind the gonads. Thence they extend slightly into the region of the acetabulum posteriorly they are distributed almost upto the caeca covering the blind terminations of the caeca. The eggs are 111 - 124 μ by 61 - 74 μ.

Discussion. *Euclinostomum bhagavantami* n. sp., described above differs markedly from the only known adult form, *Euclinostomum heterostomum* (RUDOLPHI 1809) BAER 1933, the points of difference being as follows: (1) The caecal diverticula are unbranched in *E. heterostomum* whilst in the new species all the diverticula are simple and unbranched. (2) The uterine sac occupies less than half the width of the intercaecal space in *E. heterostomum*, whereas it fills most of the space between the caeca in the new species. Further it is also noteworthy that the utero-duct in the former communicates with the uterine sac at its anterior end whilst in *E. bhagavantami* it opens into the sac halfway down. (3) In *E. heterostomum* the front testis extends anteriorly well beyond the middle of the post-acetabular portion of the body, on the other hand, it does not extend beyond the equatorial plane of the post-acetabular region in the new para-

- over

site. (4) The two species also differ in their sucker ratio and principal body measurements.

In view of the distinguishing characters exhibited by the worm described herein, it is considered to be new to science. It is proposed to name the new species as *Euclinostomum bhagavantami* in honour of Professor S. BHAGAVANTAM, Vice-Chancellor, Osmania University.

Specific diagnosis: Body 12.37 by 3.37 mm., anterior end truncated and attenuated; suckers unequal, oral sucker 0.53 by 0.38 mm. surrounded by an oral field, acetabulum 1.51 mm. in diameter, well developed and muscular, ratio 1 : 3; intestinal caeca provided with 9 and 12 simple, unbranched external diverticula in the post-acetabular region; testes behind middle of post-acetabular portion of body, anterior testis V-shaped 1.44 by 1.06 mm., posterior testis heart-shaped 1.06 by 0.91 mm.; ovary 0.6 by 0.26 mm. kidney-shaped nearer anterior testis; genital pore at cephalic level of anterior testis; uterine sac very huge extending upto acetabulum; eggs 111—124 μ by 61—74 μ.

Host: *Demiegretta asha.*

Habitat: Intestine.

Locality: Hyderabad Deccan (India).

The type specimen is deposited in the Zoological Museum of the Osmania University.

Euclinostomum heptacaecum n. sp. Jaiswal, 1957

A solitary immature specimen of this species was recovered from the body cavity of the common edible fish "Thood Dokh", *Channa (ophicephalus) punctatus* in December, 1949.

The body of the fluke is elongate having a broadly rounded posterior and a truncated anterior end. It is 7.7 mm. long and 2.24 mm. broad at the middle of the post-acetabular portion of the body. The cuticle is thin and smooth, being devoid of spines. The oral sucker is feebly developed measuring 0.30 by 0.14 mm. It is capable of being protruded and retracted into the truncated anterior end of the body. The acetabulum is well developed and is placed at a distance slightly less than $^1/_3$th of the body length from the anterior end. It is somewhat oval in shape measuring 1.66 by 1.31 mm. The two suckers are distinctly unequal in size, the acetabulum being roughly $5^1/_2$ times as large as the oral sucker.

In the absence of the pharynx, the mouth leads directly into a short oesophagus measuring 0.16 mm. in length. The intestinal crura are fairly broad extending posteriorly to the caudal end. They give origin to 7 external, simple diverticula on each side, the anterior most pair lying slightly posterior to the level of the hind border of the acetabulum. They present a swollen appearance with bluntly rounded tips.

The excretory bladder opens caudally by means of a terminal excretory pore.

The testes are placed one behind the other, the anterior testis projecting slightly beyond the mid-plane of the post-acetabular portion. The anterior and posterior testes measure 0.72 by 0.36 mm. and 0.63 by 0.36 mm. respectively. A distinct S-shaped cirrus pouch lies immediately anterior to the front testis.

The germarium, measuring 0.29 by 0.2 mm., is oval in shape. It is placed between the two testes, being nearer to the anterior than to the posterior testis. The shell gland lies posterior to the ovary, measuring 0.59 by 0.35 mm. A long and narrow utero-duct communicates with a barrel-shaped uterine sac towards its anterior end. The sac measures 1.6 by 0.58 mm. A distinct metraterm is lacking, and hence the uterine sac opens directly to the exterior at its posterior end. The vitellaria were not developed in the worm under study.

Discussion: The worm described above differs from *E. clarias* DUBOIS and *E. multicaecum* TUBANGUI 1935, in the anterior extent of the uterine sa also in the truncated character of the anterior end of the body. It is closely to *E. indicum* BHALERAO 1942, also cribed from the same host. It can, how be differentiated from the latter owin the presence of a much broader uterin and a truncated anterior end. The two sp also differ in the number of diverticul there are 7 pairs in new species and *E. indicum*. The swollen tips of the di ticula of the former are unbranched wh the fifth one in *E. indicum* has a bifid tip.

Fig. 1. *Euclinostomum heptacaecum* n. sp. Ventral View.

The new species is proposed to be nam *Euclinostomum heptacaecum* in virtue of possessing seven pairs of diverticula the caeca.

Specific diagnosis: Body 7.7 mm. by 2.24 mm with truncated anterior end; suckers un qual, oral sucker 0.30 by 0.14 mm., feeb developed; acetabulum 1.66 by 1.31 mm. we developed, ratio 1 : 5.5, intestinal crura br ader in the pre-acetabular zone and giv origin to 7 unbranched external diverticul on each side in post-acetabular region; teste one behind the other, anterior testis 0.72 b 0.36 mm., posterior testis 0.63 by 0.36 mm ovary 0.59 by 0.35 mm., receptaculum seminis anterior testis; uterine sac L-shaped, fa apart from acetabulum.

Host: *Channa (Ophicephalus) punctatus*

Habitat: Body Cavity.

Locality: Hyderabad (Deccan) (India)

The type specimen is deposited in the Zoological Museum of the Osmania University.

Euclinostomum channai n. sp. Jalawal, 1957

In December, 1949, while examining certain food fishes of Hyderabad State for the presence of helminth parasites, the writer once obtained from the intestine of "Flood Murrel", *Channa (Ophicephalus) marulius*, an isolated specimen of a new metacercarial form of *Euclinostomum*.

The distome is somewhat fleshy having a truncated anterior and a rounded posterior end, with a slight constriction in the region of the acetabulum which separates a short and narrow anterior portion from a long and broad posterior region of the body. The worm measures 12.06 mm. long by 3.51 mm. in greatest width at about the middle of the body. The cuticle covering the body is thin and unarmed. The oral sucker is subterminal and feebly developed. It measures 0.61 by 0.36 mm. and is surrounded by distinct oral field, as in the previous species. In the live condition the worm is capable of protruding its oral sucker from its truncated anterior end. The acetabulum is strongly muscular and well developed. It is rounded in shape, being located at about $^1/_6$th of the body length from the head-end. It measures 1.91 by 1.8 mm.; its lateral borders being almost in contact with caeca. The two suckers are about 1.7 mm. apart and their size ratio is 1 : 3. The pharynx is absent and the short narrow oesophagus divides into two long and thick intestinal caeca which extend posteriorly quite close to the caudal end. Passing round the acetabulum the caeca slightly curve inwards. As they proceed backwards they give origin to nine unbranched external diverticula on each side. The latter are in the form of long fingerlike processes with somewhat swollen ends.

The excretory bladder is Y-shaped, it communicates with the exterior by means of a caudally placed terminal excretory pore.

The testes are placed one behind the other with the ovary lying laterally between them. The anterior testis is crescentic and the posterior one is Y-shaped, measuring 1.0 by 0.91 mm. and 0.75 by 1.0 mm. respectively. The cirrus pouch lies between the two horns of the crescent-shaped anterior testis. The seminal vesicle, ductus ejaculatorius and the cirrus are not differentiated. The ovary is a lobed structure and lies at the equatorial plane of the post-acetabular region of the body. It measures 0.33 by 0.30 mm. and is situated lateral to the median line. The shell-gland is well developed lying posterior to the ovary. The utero-duct is a slender tube joining a long and narrow uterine sac near its anterior end. The uterine sac opens to the exterior at the female genital aperture which is situated at about the cephalic level of the anterior testis.

The vitellaria consist of small rounded follicles, which extend anteriorly upto the hind border of the acetabulum. Posteriorly they terminate a little in front of the caudal end. Behind the gonads the vitellaria are found distributed across the entire width of the body.

Fig. 10. *Euclinostomum channai* n. sp. Ventral View.

Discussion: The metacercaria under study differs from *E. clarias* DUBOIS 1929, and *E. multicaecum* TUBANGUI 1935, in the anterior extent of the uterine sac. It shows affinities with *E. indicum* BHALERAO 1942, but is excluded from it on the following grounds: (1) In the new parasite the pre-acetabular portion is sharply marked off from the rest of the body and terminates in a truncated head-end. (2) The caecal diverticula in the new species are distended and have broad and rounded terminations, whilst they are in the form of narrow processes with pointed ends in *E. indicum*. None of the diverticula in the former are branched, whereas the 5th

sp. of *E. heterocaecum* see Faizchat + Pandey (1961)

pair of diverticula in *E. indicum* ends in a bifid tip. (3) The present species is mo
than twice as long as *E. indicum* and hence differs markedly from it in bod
measurements also.

In view of the marked differences exhibited it is concluded that the wor
described above is new, for which the name *Euclinostomum channai* is propose

Specific diagnosis: Body 12.06 by 3.51 mm., anterior end truncated with
slight constriction in acetabular region; suckers unequal, oral sucker 0.64 b
0.36 mm., feebly developed and surrounded by a distinct oral field; acetabulu
1.91 by 1.8 mm., well developed, ratio 1:3; intestinal caeca broader in pre-aceta
bular region, posteriorly give origin to 9 unbranched external diverticula wit
finger-like swollen tips; testes placed behind equatorial plane of body, anterio
testis crescentic 1.0 by 0.91 mm. and posterior one Y shaped 0.7- by 1.0 mm
ovary 0.33 by 0.30 mm., lobed, placed at equatorial plane of post acetabula
region, uterine sac narrow and tubular.

Host: *Channa (Ophicephalus) marulius.*

Habitat: Intestine.

Locality: Hyderabad.

The type specimen has been deposited in the Zoological Museum of the [illegible] University.

1. Clinostomum Clarias ~~nov. spec.~~ Barbois, 1930

(Fig. A et pl. I.)

Cette espèce a été trouvée dans la cavité du corps d'un *Siluridae* d'Afrique de la sous-famille des *Clariinae*, *Clarias angolense*.

Le corps mesure 1 cm. de longueur.

La partie antérieure a un diamètre transversal de 1mm,9 qui se réduit à 1mm,7 au niveau du bord postérieur de la ventouse ventrale. Sa moitié antérieure renferme une quantité de petites cellules glandulaires piriformes, globuleuses ou elliptiques, mesurant suivant les axes 12 à 26 μ de diamètre, avec un petit noyau sphérique de 3,5 à 4,8 μ, qui doivent probablement déverser leur produit de sécrétion à la surface du champ buccal. (Pl. I, fig. 1, *c. g.*)

La partie postérieure, linguiforme, largement arrondie à l'extrémité, environ quatre fois plus longue que la précédente, mesure 2mm,7 de largeur en son milieu.

Musculature. — Sous la cuticule existe une zone musculaire fort développée, surtout sur le côté dorsal du corps, où son épaisseur atteint 210 à 220 μ — c'est-à-dire plus du quart du diamètre dorso-ventral mesuré au milieu de la partie postérieure du corps — et qui se subdivise en quatre couches qui, de l'extérieur à l'intérieur, sont les suivantes (pl. I, fig. 1, 2 et 3) :

1° la *musculature circulaire (m. c.)*, à fibres fines parmi lesquelles s'insinuent les nombreux canalicules du réseau excréteur périphérique sous-cuticulaire ;

2° la *musculature longitudinale externe (m. l.)*, à fibres fines aussi, serrées, rectilignes, formant la couche la plus étroite ;

3° la *musculature diagonale (m. d.)*, à grosses fibres formant par leur entrecroisement un réseau de grande épaisseur ; les mailles sont occupées par les cellules sous-cuticulaires dont les prolongements protoplasmiques ont traversé les deux couches précédentes ;

4° la *musculature longitudinale interne (m. l.)*, à fibres très épaisses, mais peu nombreuses.

Cette structure est identique à celle que H. von Buttel-Reepen décrit chez *Distomum ampullaceum* (1902, Taf. 8, Fig. 37). Une disposition à peu près analogue existe chez *Distomum reticulatum* dont Looss (1885) a donné la description. Mais ici existe, sous la cuticule, une première assise de fibres longitudinales qui précède la musculature circulaire, ce qui porte à cinq le nombre des couches musculaires de la paroi du corps.

Le parenchyme est traversé par les muscles dorso-ventraux (pl. I, fig. 3, *m. d.-v.*) qui se ramifient dès leur entrée dans la zone musculaire de la paroi du corps; leurs prolongements se perdent déjà dans la couche des fibres diagonales, mais il est probable qu'ils s'insèrent au delà.

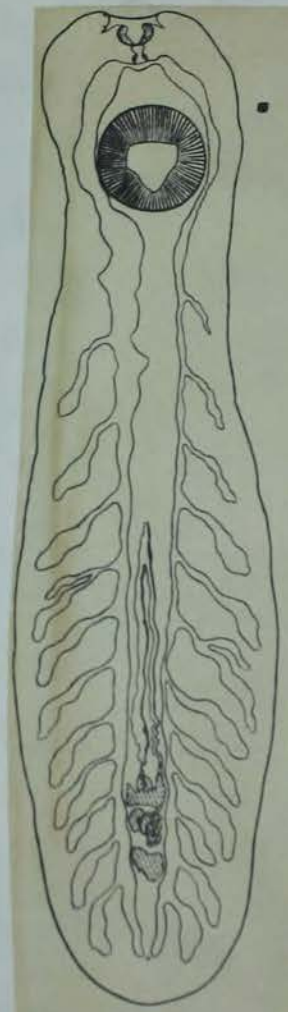


Fig. A
Clinostomum Clarias
nov. spec. Gr. 17.

Ventouses. — La ventouse buccale est petite, rétractile, peu musculeuse comparativement à la ventouse ventrale. (Pl. I, fig. 1.) Son diamètre transversal est de 360 μ ; son diamètre antéro-postérieur de 220 μ.

La ventouse ventrale dont le centre se trouve à 1mm,5 de l'extrémité antérieure du corps, est un puissant organe d'adhésion ; son contour est circulaire, sa lumière triangulaire ; son diamètre mesure 1125 μ; l'épaisseur de sa musculature atteint 360 μ.

Système digestif. — Un prépharynx, long de 90 à 100 μ, relie la ventouse buccale au pharynx. Ce dernier, plus nettement délimité même que la ventouse buccale, est globuleux ou légèrement comprimé suivant l'axe longitudinal. Son diamètre transversal est de 150 μ, son diamètre antéro-postérieur de 105 μ. Il présente intérieurement un renflement annulaire, de structure musculaire, de 25-28 μ d'épaisseur. Le reste des parois est très mince, mais délimite toujours nettement cet organe du parenchyme qui l'entoure. (Pl. I, fig. 1, *ph.*)

Braun met en doute l'existence d'un pharynx proprement dit chez les *Clinostomidae*. D'autres auteurs, par contre, en affirment la présence, tels Ramsay Wright, Mac Callum. L'examen des coupes que nous avons étudiées permet de dire que, dans cette espèce du moins, un pharynx normal existe, parfaitement délimité et possédant sa musculature.

Le pharynx s'ouvre directement

dans le tronçon transversal formé par la réunion des deux caeca. Ceux-ci, dès leur point de jonction, s'écartent diamétralement l'un de l'autre en fléchissant vers l'avant, puis au niveau même du pharynx se courbent assez brusquement et se dirigent obliquement en arrière. Ils divergent jusqu'à la hauteur de la ventouse ventrale qu'ils contournent, puis pénètrent dans la partie postérieure du corps où ils se rapprochent peu à peu de manière à délimiter le champ médian (Mittelfeld de Braun) occupé par les glandes génitales. En arrière du testicule postérieur, ils se rapprochent encore et se terminent au niveau du pore excréteur. Leur diamètre varie dans de très grandes limites : 80-360 μ.

Dès leur entrée dans la partie postérieure du corps, les caeca produisent, à intervalles réguliers et sur leur bord externe, de longs diverticules sacciformes qui peuvent bifurquer et qui se terminent en se dilatant à une distance de 180 μ environ de la surface du corps. Ils sont au nombre de 12 de chaque côté et se rattachent aux caeca à peu près au même niveau à gauche et à droite.

Une semblable disposition ne se rencontre que chez *Clinostomum heterostomum* (Rud.), mais avec moins de régularité dans l'insertion des diverticules sur le canal intestinal.

Système excréteur. — De la vésicule excrétrice dont le pore est situé dorsalement à 450 μ de l'extrémité postérieure du corps, remontent deux troncs collecteurs latéraux et extérieurs par rapport aux caeca, dont les ramifications multiples forment, dans tout le parenchyme du corps, un réseau serré, à mailles polygonales, qui devient vraiment inextricable à la périphérie de la ventouse ventrale. (Pl. I, fig. 1.) Les canalicules qui s'engendrent par ramifications successives traversent la musculature de la paroi du corps et viennent s'anastomoser dans la couche des fibres circulaires et y former un réseau périphérique sous-cuticulaire. (Pl. I, fig. 3, *c. e.*)

Système génital. — *Clinostomum Clarias* se distingue facilement des autres espèces par la petitesse de ses glandes génitales — à l'état larvaire du moins — et par leur situation dans le dernier tiers de la partie postérieure du corps. Le sac utérin (Uterussack de Braun) s'étend lui-même sur toute la longueur du second tiers, si bien que le premier tiers du champ médian reste complètement inoccupé.

Les testicules sont finement lobés et asymétriques. Le testicule antérieur (diamètre transversal 400 μ ; diamètre dorso-ventral 180 μ ; diamètre antéro-postérieur moyen 135-160 μ ; diamètre antéro-postérieur maximum — côté gauche — 440 μ) est bicorne avec concavité dirigée en avant. Le testicule postérieur (diamètre transversal 340 μ ; diamètre dorso-ventral 160-170 μ ; diamètre antéro-postérieur 360 μ) est cordiforme avec pointe dirigée en arrière.

Entre les deux testicules se trouvent, à droite, l'ovaire elliptique (diamètre transversal 160 μ ; diamètre dorso-ventral 160 μ ; diamètre antéro-postérieur 250 μ), à gauche, le peloton de l'utérus. Le canal de Laurer s'ouvre sur la ligne médiane. Le champ des glandes génitales (Genitaldrüsenfeld de Braun) s'étend sur une longueur de 1200 μ mesurée de la pointe gauche du testicule antérieur à l'extrémité du testicule postérieur. Issu du peloton, l'utérus (diamètre 45-60 μ) passe ventralement sous le bord gauche du testicule antérieur, remonte jusqu'au niveau du cinquième diverticule intestinal où il se jette dans le sac utérin qui se termine en cul-de-sac à une distance de 3mm,75 du centre de la ventouse ventrale et redescend en s'élargissant peu à peu (diamètre 90-180 μ) pour aboutir au pore génital situé devant le testicule antérieur. (Pl. I, fig. 2, *p. g.*)

Hôte. — *Clarias angolense* (cavité du corps).

Lieu. — Afrique.

Par la présence des diverticules intestinaux, *Clinostomum Clarias* se rapproche de *Clinostomum heterostomum* (Rud.). Cependant les caractères qui distinguent ces deux espèces sont nombreux et se résument dans le tableau suivant :

	Cl. Clarias nov. spec.	*Cl. heterostomum* (Rud.)
Long. corps	10 mm.	6,7-9 mm.
Larg. corps au niveau de la ventouse ventrale	1mm,7	2mm,5
Larg. corps au milieu de la partie postérieure du corps	2mm,7	3mm,5
Ventouse buccale { diam. transversal / diam. longitudinal	300 μ / 220 μ } moy. 260 μ	270-330 μ / 310-390 μ } moy. 317 μ
Ventouse ventrale, diamètre	1125 μ	1400 μ
Champ des glandes génitales	dans le dernier tiers de la partie postérieure du corps	dans la seconde moitié de la partie postérieure du corps
Testicules	petits	beaucoup plus grands
Ovaire { diamètre longitudinal / diamètre transversal	250 μ / 160 μ	? / 500 μ
Utérus	se termine en avant à 3mm,75 du centre de la ventouse ventrale, c'est-à-dire qu'il atteint à peu près le milieu de la longueur totale du corps	s'étend jusqu'à la ventouse ventrale
Hôte	*Clarias*	*Ardea ; Nycticorax*

Clinostomidae

Euclinostomum gastrocaecum ~~sp. n. (Fig. 1a)~~ B. Iqbal, 1982

Host: *Ophiocephalus marulius* (Ham).
Location: Liver.
Locality: Haleji Lake, W. Pakistan.
Number: 105 specimens from 61 hosts.

Body stout, linguiform, convex dorsally and concave ventrally. Length 4.68–7.8, width 1.55–2.13. Oral sucker subterminal, small 0.067×0.057–0.07×0.11, surmounted by a prominent collar-like fold of body wall. Pharynx indistinct. Oesophagus 0.054×0.03–0.12×0.06 in size, swollen bulbously at the anterior end without forming typical pharynx. Caeca long, reaching to posterior extremity, thin-walled and slightly sinuous, filled with black material, the blood of the host. Each caecum with 7–9 lateral branches, unequal in length. Stomach portions well differentiated occupying almost the whole preacetabular region. Anterior body region contain numerous bright staining gland cells which are more numerous around the stomach portions. Acetabulum in anterior third of the body, much larger than oral sucker, 0.54×0.46–0.12×0.09. Testes at about middle of the hind body. Anterior testis usually transversely elongated, concave anteriorly and convex posteriorly, larger than posterior testis, 0.18×0.32–0.24×
×0.51. Posterior testis Y-shaped, 0.18×0.25–0.31×0.48. Genital atrium opening in front of anterior testis. Ovary on the right of median line, intertesticular, small, 0.09×0.1–0.15×0.21. Uterus not reaching to acetabulum, uterine sac 0.8×0.07–1.2×0.18, terminating 0.4–0.52 behind the acetabulum. Vitellaria extending up to the first lateral branch of intestinal caeca, confluent behind posterior testis reaching to posterior extremity. Excretory plexus extending in peripheral parenchyma. Excretory vesicle small, with dorsal subterminal opening.

Remarks: *Euclinostomum gastrocaecum* sp. n. is separated from the known species of the genus by having strongly developed stomach portions surrounded externally by numerous unicellular glands, sinuous thin-walled unequal 7–9 lateral branches of caeca. This is larger than *E. indicum* Bhalerao 1942, smaller than *B. multicaecum* Tubangui et Masiluñgan, 1935, from the related fish hosts. The uterus reaches more anteriorly than in *E. multicaecum* and *E. clarias* (Dubois, 1930), but not as much as in *E. heterostomum* (Rud. 1809) i.e., not reaching to the posterior border of acetabulum. There is a sucker ratio difference between *E. gastrocaecum* sp. n. and the known species.

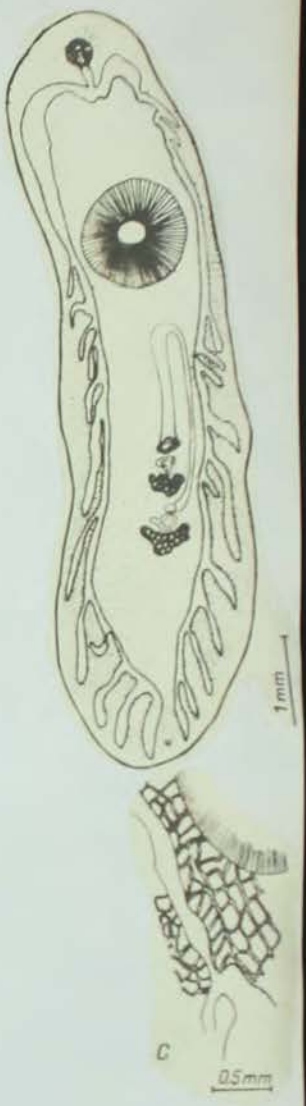
Clinostomidae

Euclinostomum heterocaecum ~~sp. n. (Fig. 1 b, c)~~ Bilqees, 1978.

Host: *Ophiocephalus marulius* (Ham).
Location: Muscles.
Locality: Haleji Lake, W. Pakistan.
Number: 79 specimens from 37 hosts.

Body stout, linguiform, both ends rounded, post-testicular region slightly broader. Length 10.6–10.8, width 2.3–3.2. Oral sucker subterminal, small, 0.25×0.32–0.27×0.30; surmounted by a less prominent fold of body wall. Pharynx small, 0.07×0.03–0.15×0.12. Oesophagus distinct, 0.45×0.12–0.5×0.14. Caeca long, reaching to posterior extremity. Ten or eleven unequal lateral branches arising from each caecum in the postacetabular region. In addition one or two preacetabular branches also present in most of the specimens. Acetabulum in anterior third of the body, 1.3×1.3–1.5×1.6. Sucker ratio 1 : 5–1 : 6. Testes in posterior half of the body, transversely elongated, irregular in outline. Anterior testis small, 0.44×0.21–0.64×0.18, posterior larger, 0.64×0.24–0.78×0.29. Cirrus sac pyriform, in front of anterior testis. Genital atrium muscular, genital pore slit-like. Ovary intertesticular, a little left of the middle line, spherical, small, 0.5×0.3–0.10×0.09. Shell gland and oviduct postovarian. Uterine duct curves on the left side of the anterior testis and continues anteriorly to join the uterine sac. Uterine sac long, tubular, 1.7×0.08–1.8×0.07 in size, terminating 0.5–0.62 behind the acetabulum. Vitelline follicles extending anteriorly to the postacetabular region, more prominent in the extracaecal field. Excretory tubules delicate, running transversely and longitudinally at right angles to each other forming square net work throughout the outer body parenchyma. Excretory pore subterminal.

Remarks: The presence of preacetabular lateral branches of caeca, the ovary situated at the left of median line and the delicate excretory tubules running at right angles to each other forming small squares throughout the outer body parenchyma are the characters which serve to distinguish *E. heterocaecum* sp. n. from known species of the genus in which preacetabular lateral branches of caeca are absent, the ovary is always at the right of median line and the excretory tubules are not regularly arranged running at right angles to each other. The differences in the body size and sizes of various structures are usually variable characters and are not counted in proposing the new species although these are noteworthy. *Euclinostomum heterocaecum* sp. n. can also be differentiated from the above described *E. gastrocaecum* sp. n. by absence of the large stomach portions, unicellular glands in the forebody, and the posteriorly dilated uterine sac. The sucker ratio, number of lateral branches of caeca, distance between the termination of uterine sac and acetabulum and the pattern of excretory tubules is also different in the two species.



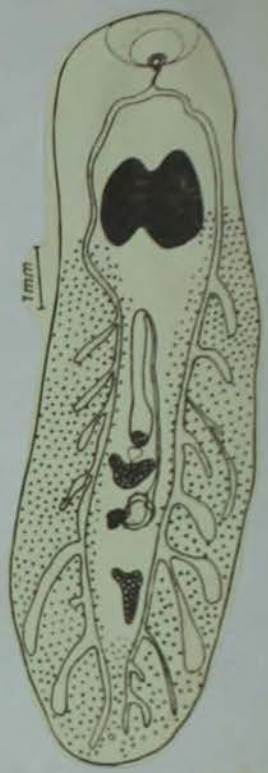
Clinostomidae

Euclinostomum nephrostomum ~~sp. n. (Fig. 2 a, b)~~ B. Iqees, 1972

Host: *Ophiocephalus marulius* (Ham).
Location: Kidney.
Locality: Haleji Lake, W. Pakistan.
Number: 7 specimens from 5 hosts.

Large and stout, linguiform, with rounded and flattened anterior end, posterior extremity also rounded. Maximum width at the testicular region. Length 11.32–12.89, width 3.6–4.0. Oral sucker subterminal, small 0.3–0.4×0.4–0.5, surmounted by a thick fold of body wall. Pharynx very small 0.02×0.025–0.05×0.03. Oesophagus is a delicate tube, 0.4×0.04–0.5×0.045. Caeca long reaching to posterior extremity, from which arise 7–10 unequal irregular lateral branches. In the paratype these are seven at the right including a very small sixth branch, and 9 at the left. The free end of some of these branches may bifurcate, as in the holotype the third and sixth branch is bifurcated. The anterior branches are usually small and posterior longer with dilated ends. Acetabulum near anterior extremity, in the anterior 1/3 of body, irregular in outline, concave anteriorly and posteriorly in the middle appearing as a bilobed structure, strongly developed, much larger than the oral sucker, 1.26×2.16–1.36×1.65. Sucker ratio 1 : 4 in length and 1 : 4–1 : 5 in width. Testes almost in the middle of the posterior half of body. Anterior testis V-shaped, 0.32×0.5–0.35×0.65, posterior Y-shaped 0.78×0.38–0.87×0.39. Cirrus sac in front of anterior testis, pyriform; genital atrium muscular, opening by a median pore. Ovary intertesticular, submedian, slightly towards right, small, 0.26×0.22–0.27×0.25. Oviduct large extending up as a thin uterine duct meeting the uterine sac. Uterine sac dilated posteriorly, measuring 2.30–2.46 in length, 0.28–0.30 in width, terminating 1.0–1.4 behind acetabulum. Vitelline follicles numerous extending up to the posterior border of acetabulum. Excretory tubules relatively thick, forming an irregular network throughout the outer body parenchyma. The arrangement of tubules is symmetrical as four main tubules, two on each side, although forming an irregular net work they remain distinctly separated in the middle line. This symmetrical arrangement of excretory tubules is more prominent in the postacetabular region above the uterine sac where no other organs are located.

Remarks: *Euclinostomum nephrostomum* sp. n. is unique in having a bilobed acetabulum not reported previously in the genus. Dissimilarity of the pretesticular and posttesticular lateral branches of caeca is also peculiar. The number of main excretory tubules is four, arranged symmetrically, forming an irregular net work, different than in the above mentioned new species *E. heterocaecum* from the same host but of different location. By the presence of these three peculiar characteristics *E. nephrostomum* is readily differentiated from the known and other new species of the genus described here. The specific name refers to its location in the kidney of the host.



Clinostomidae

Euclinostomum sp. indet. (metacercaria)
Prudhoe and Hussey, 1977

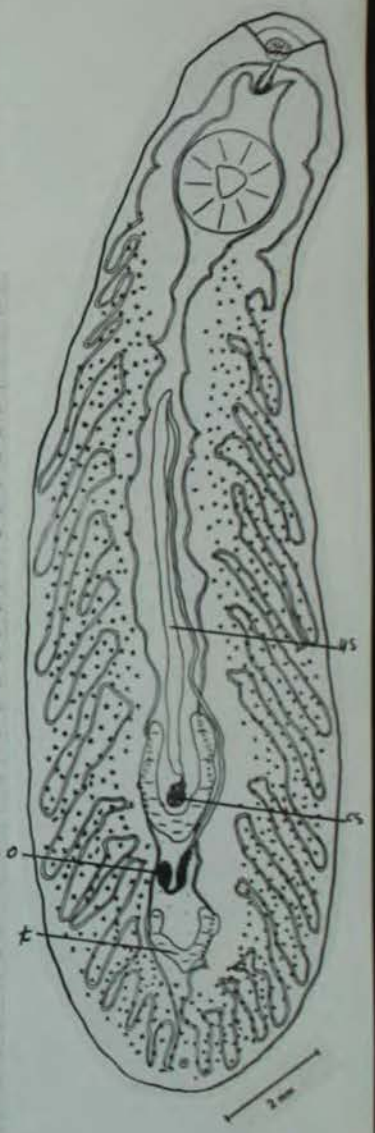
(Figure 7)

A single specimen was recovered from the body-cavity of *Clarias gariepinus*. It is large with a total length of 19,3 mm and a maximum width of 5,37 mm at the level of the anterior testis. The body is elongate, somewhat dorso-ventrally flattened, with rounded ends. The cuticle is smooth. The oral sucker is bulbous, with a diameter of 0,40 mm, and is situated on the floor of a cephalic depression, which measures 0,75 mm in width and 0,22 mm in depth. The ventral sucker has a diameter of 1,75 mm, is rounded and well developed, with a triangular aperture, and the oral/ventral sucker ratio is about 1:4,4.

The oesophagus is about 0,27 mm in length and opens posteriorly into an elliptical muscular bulb measuring 0,275 × 0,155 mm. The intestine leaves the muscular bulb ventrally and almost immediately bifurcates to produce two limbs which pass backwards to the posterior end of the body. There are 16 finger-like postero-lateral branches to the right intestinal caecum and 14 similar branches to the left caecum. The main limbs are swollen with food giving rise to bulbous swellings at intervals. The excretory pore lies in the median dorsal plane at 0,58 mm from the posterior end of the body. No excretory bladder or ducts have been made out in the present specimen. The genital pore is a transverse slit which opens into a genital atrium lying over the anterior part of the cirrus-sac. The sac itself is rounded, with a diameter of 0,43 mm, and contains a bipartite seminal vehicle. Both testes are situated in the posterior third of the body, the hinder one being within the last sixth of the total length of the body, 2,24 mm from the posterior end. They are transversely elongate and more or less U-shaped. The anterior testis lies at about 4,7 mm from the posterior end of the body and measures 2,2 mm in length and 0,3 mm in thickness, which is more or less uniform along its entire length, whilst the posterior testis has a length of 1,06 mm and a thickness of 0,20 mm. The ovary lies between the two testes, a little to the right of the median line. It is small and oval, measuring 0,34 × 0,16 mm. An oviduct leaves the dorsal side of the ovary near its hinder end, and then turns and enters an area occupied by diffuse glandular material destined to form the "shell"-gland complex and the seminal receptacle. From this area, the uterus extends forward, following the left-hand limb of the gut, although anterior to the foremost testis it lies between the caeca. At a point 2,85 mm posterior to the ventral sucker, it enters the uterine sac subterminally. This sac is elongate (6,9 mm) with an average width of 0,08 mm. The posterior end of the uterine sac is rounded and almost reaches the cirrus-sac. A short, rather indistinct, metraterm with thin walls leads from a point 100 μm forward from the hinder end of the uterine sac to the genital atrium. Many heavily-nucleated, ovoid, vitelline follicles, 20 × 17 μm, are scattered in the parenchyma above and below the intestinal caeca. They extend from just behind the ventral sucker to the hinder end of the body, where they also occur between the intestinal caeca behind the posterior testis, although they are absent from the area around the excretory pore.

Fischthal & Kuntz (1963) proposed the new name *Euclinostomum dollfusi* for two mature specimens, determined by Dollfus (1950) as *Euclinostomum heterostomum* (Rud.), from *Ardea goliath* in Zaire. According to Dollfus' Figure 52, one of these specimens possesses no prepharynx, but an oesophagus, and the uterus opens into the middle region of the uterine sac; features which the American authors apparently consider to be of sufficient significance for specifically separating the specimens from *E. heterostomum*. Dollfus also figures (Figure 53) an immature specimen from the same host, but the worm appears to have no oesophagus and the uterus opens into the anterior region of the uterine sac, features that are accredited to *E. heterostomum*. It is noted, however, that in specimens of *Euclinostomum heterostomum* from *Scopus umbretta* in Rhodesia, and examined by the present writers, the uterus opens into the middle region of the uterine sac when containing eggs, but into the anterior region of the sac when no eggs are present. Otherwise, the two sets of specimens are identical.

The immature specimen depicted by Dollfus agrees exceedingly well with the unspecified specimen described above in its larger size and particularly in the possession of 14 to 16 postero-lateral branches to each intestinal caecum. In these features this form appears to differ from the metacercariae of *E. heterostomum*, which is distinctly smaller and has only 8 to 12 branches to each caecum. Whether or not the present worm is specifically distinct from



over-

the latter species cannot at the moment be determined satisfactorily, for the number of intestinal branches might increase with the size of the worm.

It is perhaps opportune to mention here that clinostome or "yellow-grub" disease appears to be very common and widespread among freshwater fishes in Central Africa. Through the lack of information it is not yet possible to state with certainty whether these trematodes are as common among similar fishes in southern Africa, but there is no reason to assume not. In the senior writer's experience, where these worms are found, there seems to be a high frequency of infestation in fishes, and this is probably due to the unusually high production of embryos in the redial generation in the life-history of these flukes. A mother-sporocyst, for instance, produces one redia that is followed by at least two generations of rediae, the last of which may completely fill the digestive gland of its molluscan host. In North America it has been found that a *Helisoma* snail with a half-inch shell-diameter harboured about 2 000 rediae of *Clinostomum marginatum*, whilst another snail of the same genus, but with a shell-diameter of one inch, harboured about 4 000 rediae of the same species of fluke, thus suggesting that the number of rediae present increases with the size of the snail-host. Since cercaria-producing rediae were each found to contain up to 300 fully-formed cercariae, as well as embryos in various stages of development, it is clear that an enormous number of cercariae may be developed. A single infested snail might therefore contain more than 500 000 fully or partially-developed cercariae, and during the course of such an infestation many millions of free-swimming cercariae would be produced. The casualties among these cercariae are undoubtedly enormous, but a large number still survives to account for the high infestation by metacercariae in piscine hosts.

In some regions of the world, fish carry such heavy infestations of these grubs as to be condemned for human consumption, but this appears to have been done purely for aesthetic reasons. It should be noted, however, that there are several records of domestic cats harbouring adult clinostomes, which are mainly sanguinivorous. Moreover, there are cases on record of acute pharyngitis in man in Israel (Witenberg 1944) and Japan (Yamashita 1938) due to clinostomes. Such infestations very probably arose from eating uncooked or only partially-cooked fish.

EUCLINOSTOMUM

Ithyoclinostominae n. subfam.

Subfamily diagnosis. — Clinostomidae: Body very long, slender, attenuated for a considerable distance posterior to acetabulum. Oral sucker surrounded by collar-like thickening. Ceca simple, without lateral branches. Acetabulum very close to oral sucker. Testes tandem, near posterior extremity, with ovary between. Genital pore pretesticular. Vitellaria occupying greater part of posterior half of body, confluent in median line. Uterus ascending a short distance anterior to fore testis, but not beyond anterior limit of vitellaria.

Ithyoclinostomum Witenberg, 1926

Generic diagnosis. — Clinostomidae, Ithyoclinostominae: Body very long, slender, especially at anterior part. Oral sucker surrounded by collar-like thickening. Ceca simple, without lateral branches, Acetabulum close to anterior extremity. Genital complex confined to somewhat swollen posterior portion. Parasitic as larva in fish, as adult in Ardeiformes.

Genotype: *I. dimorphum* (Dies., 1850) (Pl. 79, Fig. 959), in *Ardea cocoi;* Brazil.

ITHYCLINOSTOMUM Witenberg, 1926. Syn. *Clinostomum* Leidy, 1856 *pro parte*.

Clinostominés de très grande taille pouvant atteindre plusieurs centimètres. Tous les organes génitaux sont contenus dans la moitié postérieure du corps. Adulte chez les Ardéiformes.

Espèce type: *Ithyclinostomum dimorphum* (Diesing, 1850).

Ithyclinostomum dimorphum (Diesing, 1850).

Longueur: 60 à 100^{mm}; largeur maxima: 6^{mm}.

La région antérieure du Ver, dépourvue d'organes génitaux, a 2^{mm} à 2^{mm},7 de large. La ventouse orale est de grande taille; son ouverture mesurant 0^{mm},5 de diamètre. La ventouse ventrale a 1^{mm},6 de diamètre. Les testicules et l'ovaire sont fortement lobés. L'utéroducte débouche dans l'extrémité postérieure de l'utérus. Les glandes vitellogènes occupent toute la moitié postérieure du champ génital. Les œufs ont 125 μ sur 60 μ. Adulte chez *Ardea cocoi* L.

Les formes larvaires décrites par DIESING sous le nom ci-dessus, chez divers Poissons brésiliens doivent se rapporter selon BRAUN (1901), vu leur taille restreinte, à l'une ou à l'autre des autres espèces sud-américaines.

From Baer, 1933

Ithyclinostomum Witenberg, 1926
~~Clinostomum~~ dimorphum (Diesing, 1850) ~~Braun, 1899~~

ITHYOCLINOSTOMUM

Nephrocephalinae Dollfus, 1930

Subfamily diagnosis. — Clinostomidae: Body large, nearly uniform in breadth, unspined. Oral sucker small, surrounded by reniform collarlike thickening. Prepharynx present. Pharynx well developed, esophagus short. Ceca sinuous anteriorly. Acetabulum large, about one third to one fourth of body length from anterior extremity. Testes tandem, in posterior half of body. Cirrus pouch elongate, curved, posttesticular. Genital pore median, subterminal. Ovary submedian, intertesticular. No seminal receptacle. Laurer's canal present. Vitellaria extending in lateral fields from acetabular zone to posterior extremity. Uterus ventral, reaching to acetabulum; eggs large, embryonated; miracidia oculate. Excretory vesicle small; excretory plexus extending in peripheral part of body. Parasites of reptiles and mammals.

Nephrocephalus Odhner, 1902, nec *Nephrocephala* Dies., 1858

Syn. *Opisthophallus* Baer, 1923

Generic diagnosis. — Clinostomidae, Nephrocephalinae: Body large, of nearly uniform breadth, unspined. Acetabulum larger than oral sucker, at about middle of anterior half of body. Anterior extremity obliquely truncated as in *Clinostomum*, forming a midventrally emarginate, reniform muscular collar around small oral sucker. Prepharynx present. Pharynx comparatively large, esophagus short. Ceca reaching to posterior extremity, with two diverticles at sinuous anterior part. Testes tandem in posterior half of hindbody, separated one from the other by ovarian complex. Cirrus pouch sigmoid, with its anterior end at level of posterior testis; vesicula seminalis tubular, winding; pars prostatica weakly developed; cirrus long, posttesticular. Genital pore median, near posterior extremity. Ovary to right of median line, intertesticular. No receptaculum seminis. Vitelline follicels very small, in lateral fields of hindbody. Uterus ascending on the left as far as acetabulum, then descending on the right; eggs large, embryonated; miracidia oculate. Excretory system forming network throughout. Parasitic in digestive tract of reptiles and mammals.

Genotype: *N. sessilis* Odhner, 1902, in crocodiles; Nile.

Metacercaria on peritoneum of *Heterotis niloticus* — Dollfus (1930). If *Distoma bagri-incapsulatum* Wedl, 1861, be the larva of *N. sessilis* Odhner, the correct specific name of the genotype should le *N. bagri-incapsulatus* (Wedl, 1861). No figure available. – [illegible] Stunkard, 1911

Representatives from mammals:

N. fuhrmanni (Baer, 1923) (Pl. 90, Fig. 1082), in *Hippotragus beckeri*: Sudan. Baer (1923) synonymized this species with *N. bagri-incapsulatus* (Wedl, 1861) from *Bagrus* sp.

Clinostomatidae

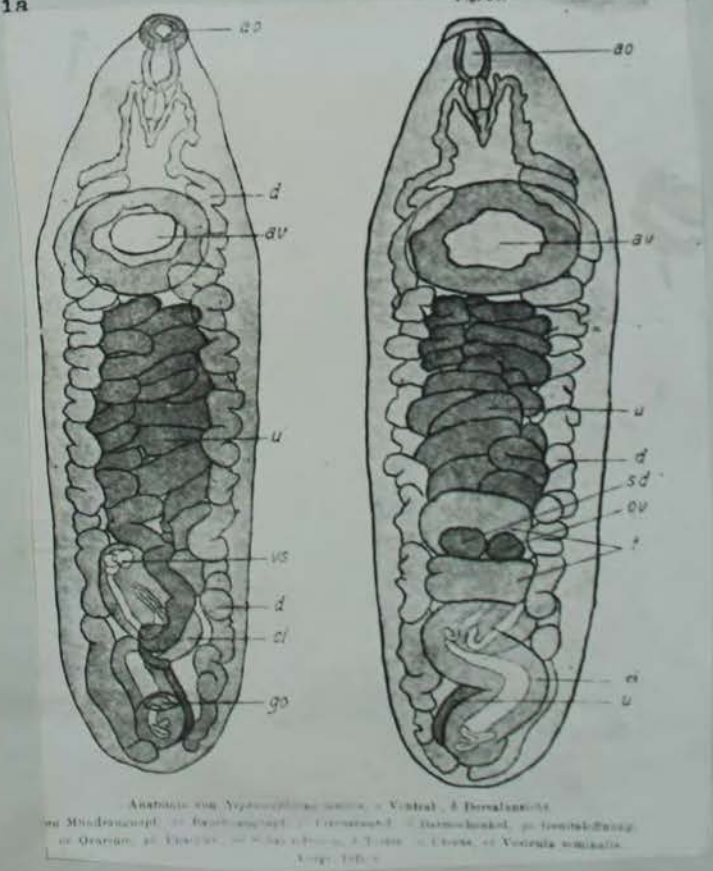
Nephrocephalus sessilis Odhner,1902

Host: Crocodilus niloticus Locality: Sudan (from Miestinger (1911))

Size 12 to 14 by 2.5 to 4 mm. About equally wide; thick bodied. Cuticula unspined, very thick. Anterior end with muscular collar projecting above oral sucker. Oral sucker bell-shaped, ######d###### Acetabulum powerful, sunk into body; about 1 mm. deep, 0.75 mm. long. Prepharynx short; pharynx about 0.3 long and a little thicker. Esophagus of same length. Ceca long, reaching hind end; much swollen in anterior part; giving off anterior pouches which may reach to level of oral sucker. Excretory system net-like. Testes# large, two, smooth, tandem immediately behind middle of hindbody. Between them on the right is the relatively small ovary. Sem. rec. lacking; Laurer's canal present. Shell gland complex between testes. Vitellaria of very small follicles along sides of hindbody. Uterus at first on left side of hindbody, reaching to acetabulum, then posteriorly on other side of body to median genital pore near posterior end of body. Cirrus sac as in gasterostomes; anterior end at level of hind testis . Eggs 114 by 66 u, containing ripe miracidium with eyespots.

Location: esophagus.

Congo specimens from trachea. Eggs 120 by 55 60 u. without ripe miracidia



Nephrocephalus bagri-incapsulatus (Wedl, 1861) Dollfus, 1930
Metacercaria (Fig. 2)

Host: *Clarias senegalensis* Cuvier and Valenciennes (Clariidae).

Habitats: Encysted in mesenteries, stomach wall, liver, fat bodies, kidneys, body cavity.

Dates: 16, 19 April 1964.

Specimens deposited: USNM Helm. Coll. No. 71634.

Description (based on 22 metacercariae, eight measured): Body elongate, widest at acetabular level or just preacetabular, extremities round, tegument unspined, 4,200-8,100 long by 1,270-1,870 wide. Eye spots or pigment granules present in some worms. Gland cells filling forebody. Oral sucker subterminal ventral, transversely elongate, 310-430 by 360-690; acetabulum round to longitudinally or transversely elongate, in anterior body half, position variable and depending upon age of metacercaria as growth of hindbody is greater than that of forebody, 830-1,070 by 890-1,250; sucker lenght ratio 1:2.50-2.10, width ratio 1:1.78-2.47. Prepharynx very short, often not apparent; pharynx muscular, frequently overlapping oral sucker dorsally, 120-220 by 120-150; esophagus very short, often not apparent; caecal bifurcation just postpharyngeal; caeca relatively wide, usually ascending sides of oral sucker before descending to posterior extremity.

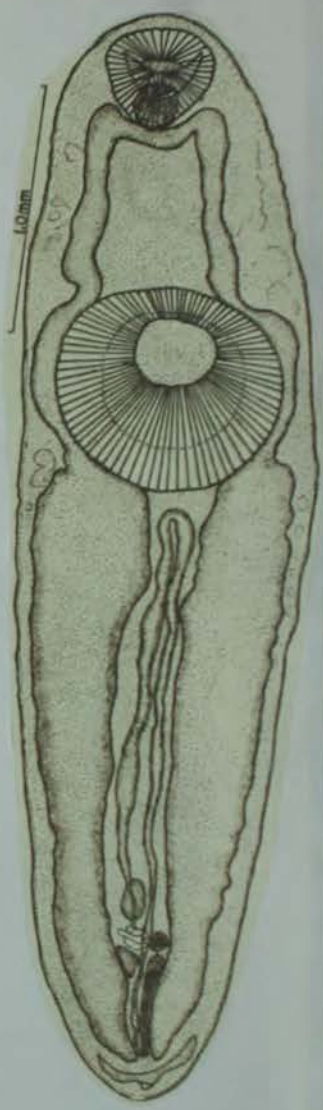
Testes two, smooth to slightly lobed, tandem, intercaecal, median to dextro-or sinistromedian, near posterior extremity, round to longitudinally, transversely or diagonally elongate; anterior testis 150-177 bv 87-110; posterior testis 110-242 bv 75-121. Vas efferens emerging from posterior margin of anterior testis and anterior margin of posterior testis, uniting at ovarian level or postovarian to form vas deferens; latter extending posteriorly to enter cirrus sac. Cirrus sac thick walled, muscular, intercaecal but may overlap caecum, dextral, straight or crescent shaped with sinistral curvature, 280-380 by 70-100, commencing opposite ovary or posterior testis, descending to dextromedian genital atrium and pore located just anterior to caecal ends and 160-440 from posterior extremity; containing a coiled, tubular seminal vesicle at proximal end, a short, slightly dilated, cell lined pars prostatica, prostate cells, and a long, tubular, sinuous, muscular cirrus.

Ovary smooth, intertesticular, intercaecal but may overlap caecum, usually dextral but may be median or sinistral, may be in tendem with testes, round to longitudinally or transversely elongate, 70-188 by 70-100. Oviduct thick walled, emerging from median surface of ovary, becomimg much coiled and surrounded by compact Mehlis' gland. Laurer's canal present. Vitellaria absent. Uteroduct slightly sinuous, ascending on left to near acetabulum before looping posteriorly as uterine sac; latter slightly sinuous, descending on right of uteroduct and cirrus sac; metraterm short, thick walled, muscular, transversely oriented, opening into genital atrium.

Excretory bladder Y-shaped, stem very short, arms much longer and extending short distance anterolateral to caecal ends; primary ducts ascending extracaecally to sides of oral sucker, branches ramifying to all parts of body; pore subterminal dorsal.

Discussion: This species was described by Wedl (1861) from metacercariae from *Bagrus* sp. (Bagridae) from the Nile in Egypt. Dollfus (1929) described a metacercaria from *Clupisudis* (=*Heterotis*) *niloticus* (Ehrenberg) (Osteoglossidae) from Cameroon as *Distoma coelomatoplocion*, but (1930) identified it as synonymous with *Distoma bagri-incapsulatus* Wedl, 1861, *Nephrocephalus sessilis* Odhner, 1902, from *Crocodilus niloticus* Laurenti (Crocodilidae) from the Nile in Sudan, and *Opisthophallus fuhrmanni* Baer, 1923, from an antilope (an error) from Sudan. Because the metacercaria has been poorly described and illustrated we are redescribing it. Dollfus (1929) erroneously described the uteroduct and uterine sac as part of the excretory system, showing it with a common stem and an anterior loop rather than as noted by us.

Young laboratory hatched *Crocodilus niloticus* were fed five cysts each and after 14 days were sacrificed; a single immature worm was recovered.



From Fischthal and Thomas, 1970

Metacercaria of *Nephrocephalus bagri-incapsulatus* (Wedl, 1861) Dollfus, 1930 (Figs. 1, 2)

Synonyms : *Distoma bagri incapsulatus* Wedl, 1861; *Opisthophallus bagri-incapsulatus* (Wedl) Baer, 1933 ; *Nephrocephalus sessilis* Odhner, 1902 ; *Opisthophallus fuhrmanni* Baer, 1923 ; *Distoma coelomatoplocion* Dollfus, 1929.

Hosts : *Auchenoglanis occidentalis* (Cuvier and Valenciennes) (Bagridae) ; *Clupisudis* (=*Heterotis*) *niloticus* (Ehrenberg) (Osteoglossidae).

Locations : Encysted in intestinal wall in *A. occidentalis* and wall of gall bladder in *C. niloticus*.

Localities : Volta River near Lawra (*A. occidentalis*), near Bawku (*C. niloticus*) ; Ghana.

Dates : 27 August 1963 (*C. niloticus*) ; December 1963 (*A. occidentalis*).

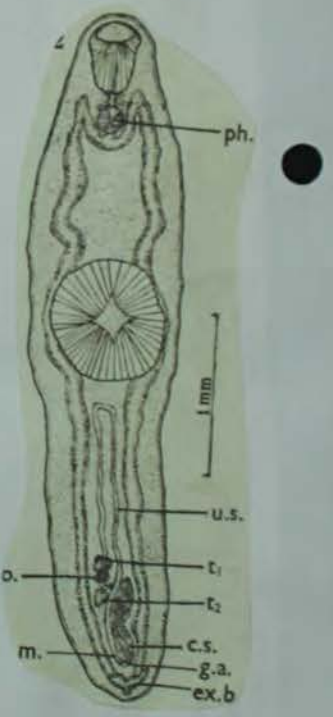
Specimens deposited : USNM Helm. Coll. No. 71638 (from *A. occidentalis*) ; No. 71639 (*C. niloticus*).

Description (based on three metacercariae from *A. occidentalis*, *two measured* ; 10 from *C. niloticus*, four measured) : Body elongate, widest at acetabular level or just preacetabular, extremities round, tegument unspined, 3,480–8,040 long by 720–2,370 wide. Eye spots or eye spot pigment granules present in some specimens. Forebody parenchyma filled with gland cells. Oral sucker transversely elongate in specimens from *A. occidentalis* (330–420 by 600–820) but round to longitudinally elongate in specimens from *C. niloticus* (320–400 by 290–330) ; acetabulum round to longitudinally or transversely elongate, in anterior half of body, position variable depending on age of metacercaria as growth of hindbody is more rapid than forebody, 650–1,410 by 640–1,320 ; sucker length ratio in *A. occidentalis* 1:3·27–3·36, in *C. niloticus* 1:1·81–2·07; sucker width ratio in *A. occidentalis* 1:1·61–1·85, in *C. niloticus* 1:2·09–2·31. Prepharynx very short, often not apparent; pharynx muscular, frequently overlapping oral sucker dorsally, 150–230 by 80–180 ; oesophagus very short, often not apparent; caecal bifurcation immediately post-pharyngeal ; caeca relatively wide, usually ascending sides of oral sucker before descending to posterior extremity.

Testes two, smooth to slightly lobed, tandem, intercaecal, median to dextro- or sinistromedian, near posterior extremity, round to longitudinally, transversely or diagonally elongate ; anterior testis 70–265 by 70–365, posterior testis 70–225 by 90–405. Cirrus sac thick walled, muscular, intercaecal but may overlap caecum, dextral, straight or crescent shaped with sinistral curvature, 250–540 by 65–140, commencing opposite ovary or posterior testis, containing a coiled, tubular seminal vesicle at proximal end, a short, slightly dilated, cell lined pars prostatica, a long, tubular, sinuous, muscular cirrus, and prostate cells.

Ovary smooth, intercaecal but may overlap caecum, intertesticular, dextral, or median or sinistral, may be in tandem with testes, round to longitudinally or transversely elongate, 39–150 by 36–142. Oviduct thick walled, emerging from median surface of ovary, becoming much coiled and surrounded by compact Mehlis' gland. Laurer's canal, transverse and median vitelline ducts present. Uteroduct slightly sinuous, ascending on left to near acetabulum before looping posteriorly as uterine sac ; latter sinuous, descending on right of uteroduct and cirrus sac ; metraterm short, thick walled, muscular, transversely orientated, opening into genital atrium. Latter and genital pore 150–390 from posterior extremity, just anterior to caecal ends.

Excretory bladder Y-shaped, stem very short, arms much longer and extending short distance anterolateral to caecal ends; primary ducts ascending extracaecally to sides of oral sucker, branches ramifying to all parts of body ; pore subterminal dorsal



Discussion : The metacercaria has been described from *Bagrus* sp. (Bagridae) from the Nile in Egypt (as *Distoma bagri incapsulatus*), from *Clupisudis niloticus* in Cameroon (as *Distoma coelomatoplocian*), and from *Clarias senegalensis* Cuvier and Valenciennes (Claridae) from Nungua Lake near Accra, Ghana. The adult has been described from *Crocodilus niloticus* Laurenti (Crocodilidae) from the Nile in Sudan (as *Nephrocephalus sessilis*). As previous descriptions of the metacercaria were incomplete it has been redescribed in the present paper.

From Fischthal and Thomas, [illegible] 1968

NEPHROCEPHALUS

Odhneriotrema Travassos, 1928

Syn. *Homoscaphis* Canavan, 1933

Generic diagnosis. — Clinostomidae, Clinostominae: Body elongate, with rounded extremities. Acetabulum large, strongly suctorial, in anterior third of body. Oral sucker very much reduced; pharynx small, esophagus practically lacking. Ceca sinuous, especially in forebody, terminating at posterior extremity. Testes in posterior third of body, widely separated one from the other, anterior one submedian, posterior one median. Cirrus pouch intertesticular. Seminal vesicle convoluted. Genital pore median, intertesticular. Ovary slightly submedian, halfway between two testes or nearer posterior testis. Vitelline follicles small, extending in cecal and extracecal fields from behind acetabulum to posterior extremity. Uterus ascending sinuously to near acetabulum and then descending sinuously; metraterm strongly differentiated. Parasitic in reptiles.

Genotype: *O. microcephala* (Travassos, 1923) Travassos, 1928 (Pl. 48, Fig. 583), syn. *Nephrocephala m.* T., in esophagus of *Caiman sclerops;* Brazil.

Other species: *O. incommodum* (Leidy, 1856), syn. *Homoscaphis incommodum* (Leidy) Canavan, 1933, in *Alligator mississippiensis;* Florida.

ODHNERIOTREMA Travassos,1928
Synonym: Homoscaphis Canavan,1933
(diagnosis from McIntosh,1935)

Large flukes. Oral sucker rudimentary; acetabulum large and powerful;pharynx well developed;esophagus short or absent; intestine extending to near posterior end of body,more or less undulating in anterior portion. Genital pore ventral,median,in zone of testes. Cirrus sac well developed,reflexed, in intertesticular zone;testes tandem, in posterior third of body;ovary small, between testes; vitellaria extending from acetabulum to posterior extremity of body. Uterus forming an ascending and a descending branch of equal size; eggs embryonated,miracidium in egg showing developing sporocyst. Parasitic in mouth and esophagus of crocodylids.

Type species: Odhneriotrema microcephala (Travassos,1922) Travassos,1928.

Other species:Odhneriotrema incommodum (Leidy,1856) McIntosh,1935

Synonym: Homoscaphis incommodum (Leidy) Canavan,1933

According to McIntosh, Homoscaphis Canavan is a synonym of Odhneriotrema Travassos.

Fig. 1. *Odhneriotrema incommodum* (Leidy, 1856), ventral aspect.

Fig. 2. *Odhneriotrema incommodum* (Leidy, 1856). Egg containing miracidium with developing sporocyst.

Odhneriotrema incommodum (Leidy,1856) McIntosh,1935

Reprinted from THE JOURNAL OF PARASITOLOGY, February, 1935, Vol. 21, No. 1

ODHNERIOTREMA INCOMMODUM (LEIDY, 1856), A TREMATODE FROM THE MOUTH OF *ALLIGATOR MISSISSIPIENSIS* (DAUDIN)

Canavan (Parasitol., 25: 501–509, 1933) has recently published a redescription of *Distomum incommodum* (Leidy, 1856), and proposed a new genus, *Homoscaphis*, for the species. In the writer's opinion, *D. incommodum* is congeneric with *Odhneriotrema microcephala* (Travassos, 1922) Travassos, 1928, and the genus *Homoscaphis* Canavan, 1933, is therefore synonymous with *Odhneriotrema* Travassos, 1928.

Since Canavan has redescribed this species, a detailed description will not be given here, but attention should be called to the interpretation of certain structures, as to which there is a difference of opinion, especially since Canavan stated that the pharynx, which is well developed, was absent, mistaking it for the oral sucker. Canavan, in his description of the cirrus sac, described "a prominent

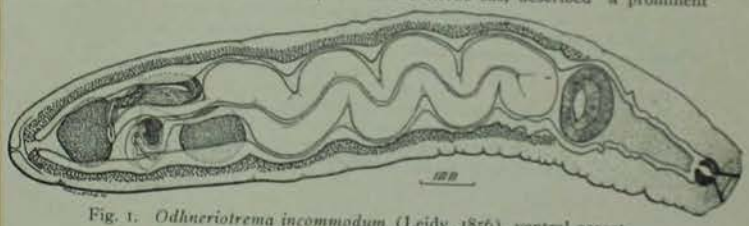


Fig. 1. *Odhneriotrema incommodum* (Leidy, 1856), ventral aspect.

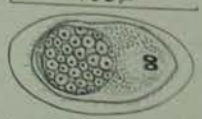
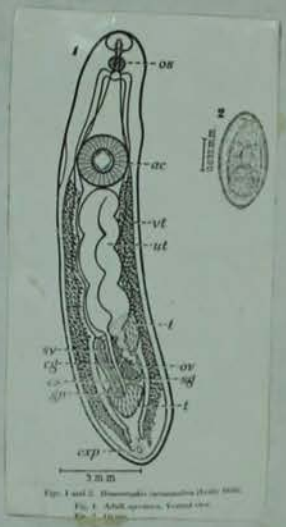


Fig. 2. *Odhneriotrema incommodum* (Leidy, 1856). Egg containing miracidium with developing sporocyst.

vesicula seminis externus." In 4 stained specimens studied by the writer, the seminal vesicle (Fig. 1) is a coiled tube contained in the reflexed proximal end of the cirrus sac. The two ducts from the testes, the vasa efferentia, are traceable to the proximal end of the cirrus sac. No caudal process was noted on the egg (Fig. 2), nor was Laurer's canal observed by the writer, but sectioned material has not been studied. In other respects Canavan's description is in harmony with the writer's observations. Three of the 4 specimens mentioned above were collected by the writer in May and June, 1930, from the tongues of 2 alligators captured near Cape Sable and Coral Gables, Florida. The fourth specimen is from Leidy's collection (U. S. N. M., Helm. Coll. No. 85), identified by Dr. Joseph Leidy as *Distoma oricola*. Although Leidy's specimen is poorly stained, certain structures are sufficiently clear to enable the writer to identify his material as Leidy's species, and to show that *D. incommodum* belongs to the genus *Odhneriotrema*, a genus erected by Travassos (Mem. Inst. Oswaldo Cruz, 21: 309–341, 1928) for a related species, *O. microcephala* (Travassos, 1922) from the esophagus of *Caiman sclerops*.

(over)

Odhneriotrema incommodum (Leidy,1856) McIntosh,1935



ODHNE RIOTRÉMA

Clinostomatidae

6. — **Trematoleipsis gerberi** n. gen., n. sp.
(Fig. 5 et 6.) Baer, 1959

Hôte : *Osteolaemus tetraspis* Cope.

Localité : Epulu (I. VIII. 58).

De nombreux spécimens de ce nouveau Trématode ont été récoltés par le Dr W. Gerber dans le pharynx d'un Crocodile à tête large. Nous avons pensé avoir affaire à *Opisthophallus hagmanni* (Wedl, 1861) qui se rencontre dans la bouche du Crocodile du Nil, mais un examen attentif a fait ressortir qu'il ne s'agissait pas seulement d'une autre espèce mais encore du type d'un nouveau genre.

La longueur totale est de 10,5 à 11 mm et la plus grande largeur mesurée en arrière de la ventouse ventrale est de 2 à 2,7 mm. La plupart des spécimens se sont légèrement repliés en arc à concavité ventrale au moment de la fixation, mais les bords latéraux ne sont pas repliés. La bouche est subterminale ventrale, entourée par une ventouse ovalaire mesurant 457 μ

(1) Dans le cas particulier, il ne faudrait pas trop s'étonner de ce caractère, car il n'est pas certain que *Dendrotaenia* soit l'hôte normal de ce parasite. En effet, c'est dans le même hôte que nous avons récolté *Prosthodendrium petrocetteris*, un Trématode hébergé habituellement par des Chiroptères.

de large et 250 μ de long. On n'observe pas ici de repli cutané en forme de fer à cheval qui entoure la ventouse orale comme chez *Opisthophallus*. Le pharynx est allongé, presque cylindrique, long de 520 μ avec un diamètre de 227 μ. On ne voit ni prépharynx, ni œsophage. Les deux branches de l'intestin sont relativement grosses et très sinueuses, mais sans diverticules. Elles s'étendent jusqu'à l'extrémité postérieure du corps où elles se rejoignent presque sur la ligne médiane. La lumière de l'intestin est tapissée d'un épithélium dont les cellules individuelles sont prolongées par un long flagelle protoplasmique, libre dans la lumière.

Le pore excréteur est subterminal, dorsal et conduit dans une vessie très courte, longue de 137 μ seulement, d'où partent de nombreuses branches d'un réseau excréteur qui se trouve essentiellement à la périphérie du corps, en dedans de la musculature.

La cuticule est très épaisse, elle a 46 μ et immédiatement en dessous se trouve la musculature sous-cuticulaire formée par une couche de fibres longitudinales et de fibres circulaires assez fines. A l'intérieur de ces couches, qui appartiennent à la paroi du corps, se trouve une très puissante musculature du parenchyme qui est constituée par une couche externe de fibres circulaires dont l'épaisseur est de 70 μ et à l'intérieur de laquelle est située une couche de gros faisceaux de fibres longitudinaux. Ces faisceaux ont environ 41 μ de diamètre et sont composés de 14 à 20 fibres chacun. Enfin, à l'intérieur des muscles longitudinaux se trouvent deux couches de fibres musculaires obliques, superposées, se croisant. La ventouse ventrale a 1,9 à 2 mm de diamètre et 1 mm de profondeur; elle est située comme chez tous les Clinostomidés à peu de distance de la bouche. Dans l'espace compris entre celle-ci et le bord antérieur de la ventouse ventrale se voient un grand nombre de cellules glandulaires, fortement éosinophiles, formant un champ glandulaire, qui a aussi été décrit chez plusieurs espèces de Clinostomes. Les glandes sexuelles sont situées dans le dernier quart du Ver. Les deux testicules sont plus larges que longs et le testicule antérieur présente à la face dorsale un lobe nettement détaché du reste de l'organe. L'ovaire, relativement petit, mesure 455 μ sur 325 μ et est situé entre les deux testicules. Le canal de Laurer, à paroi musculaire, est long et décrit de nombreuses sinuosités avant de rejoindre les conduits femelles. L'utérus est formé par une branche ascendante, à gros diamètre, qui s'étend jusqu'en arrière de la ventouse ventrale pour ensuite se replier sur elle-même en une branche descendante qui vient aboutir au métraterme qui est représenté par un fort muscle sphincter (cf. fig. 6). Le pore utérin situé à une certaine distance de l'extrémité postérieure du corps débouche à la face ventrale et à gauche par rapport à l'ouverture sexuelle mâle.

TREMATOLEIPSIS